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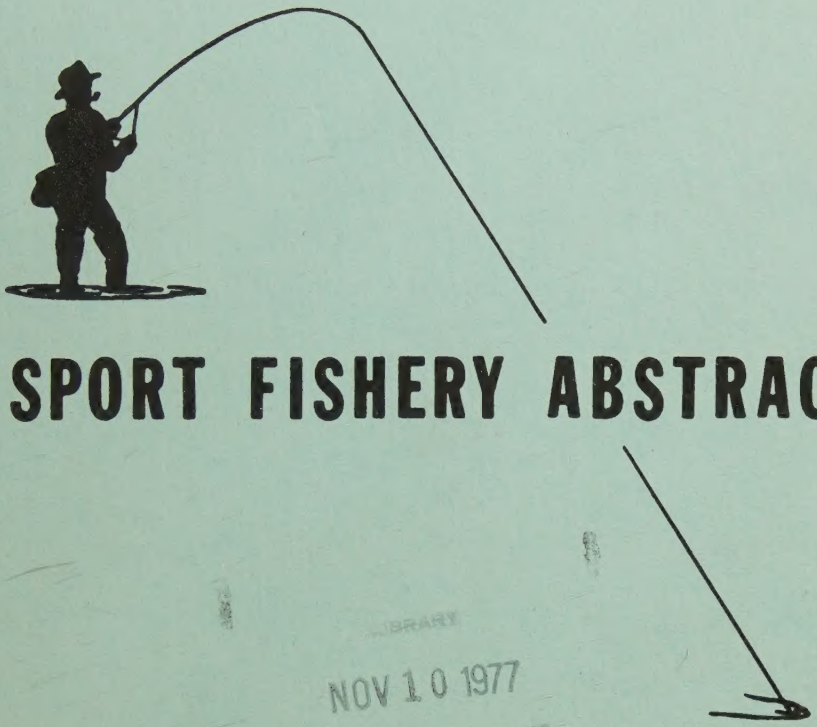

SPORT FISHERY ABSTRACTS

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Vol. 22, No. 2, 1977

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 22 Number 2 1977

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AQUATIC PLANTS AND THEIR CONTROL

76-000403 Terrell, T. L. T. ENVIRONMENTAL IMPACT OF THE WHITE AMUR (/CTENOPHARYNGODON IDELLA/ VAL.) ON SOME GEORGIA PONDS. Ph. D. dissertation, Univ. Ga. 122p; 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

The exotic white amur (/Ctenopharyngodon idella/ Val.) was introduced into several soft water, acidic ponds on the Coastal Plain of Georgia in order to test the environmental effects on utilizing this fish for macrophyte control. It was found that plankton community composition did not change significantly but that the numbers of plankters decreased. There was also a major change in the nutrient cycling within the treated ponds. Concentrations of orthophosphate, iron, magnesium, and humic acids were found to be significantly higher in the sediments of treated ponds as compared to those of controls. It was proposed that in the ponds studied, the macrophytes were acting as "nutrient pumps" removing nutrients from the sediments and releasing at least some of them into the water column. The plankton community, which was physically separated from the sediments, had to depend on the release of nutrients from the macrophytes. With the removal of the macrophytes the plankton community numbers declined. It was suggested that this "nutrient pump" function of macrophytes might be present in other systems. It was determined that introduction of the white amur for the purpose of macrophyte control could make significant changes in the nutrient cycling and plankton community numbers and that introduciton of this organism in other areas should occur only after careful consideration of these observations.

TROUT AND SALMON CULTURE

76-000404 Bailey, J. E.; Pella, J. J.; Taylor, S. G. PRODUCTION OF FRY AND ADULTS OF THE 1972 BROOD OF PINK SALMON, /ONCORHYNCHUS GORBUSCHA/, FROM GRAVEL INCUBATORS AND NATURAL SPAWNING AT AUKE CREEK, ALASKA. NOAA Fish. Bull. 74 (4): 961-971. Oct. 1976. SFA 22(2)

[NMFS, P.O. Box 155, Auke Bay, AK 99821] Production of fry and adults of the 1972 brood of pink salmon, /Oncorhynchus gorbuscha/, at Auke Creek, Alaska, was compared between a gravel incubator hatchery and natural spawning. Natural production in the creek above the hatchery weir (estimated from hydraulic sampling) was 73,900 fry (SE: 32,800) from an estimated initial seeding of 934,065 eggs (SE: 42,811) for a survival rate of 0.079 (SE: 0.035). An estimated total of 579,000 unfed fry (SE: 25,296) were released from the hatchery for a comparable survival rate of 0.743 (SE: 0.047). Exactly 84,000 of the hatchery fry and 5,500 of the creek fry were released after being marked by clipping fins. All adults returning to the weir were examined for marks, and some additional marks were recovered from sport and commercial fishermen; 667 marked hatchery fish and 74 marked creek fish were recovered. Estimated survival of hatchery fry to returning adult was only 0.0079 (SE: 0.0003) equal to 0.59 (SE: 0.071)

76-000404 CONTINUED
the corresponding estimate of 0.0135 (SE: 0.0016) for creek fry, which suggests that hatchery fry were inferior to creek fry in the marine environment; however, hatchery fry emigrated seaward 2 wk earlier than creek fry and may have encountered less favorable marine conditions. Survival from eggs to returning adult stage was 5.50 times (SE: 2.59) higher for hatchery fry than for creek fry because of much greater survival from egg to fry in the hatchery; the difference is not statistically significant. Hatchery fry were generally shorter but heavier than creek fry and emigrated seaward at a slightly earlier stage of development. No differences in size or time of return of adults could be traced to the incubation environment from which they came.

76-000405 Davis, R. H., Jr. EVALUATION OF GROWTH OF INBRED LINES AND THEIR F(1) HYBRIDS IN BROOK TROUT, /SALVELINUS FONTINALIS/, BROWN TROUT, /SALMO TRUTTA/, AND RAINBOW TROUT, /SALMO GAIRDNERI/. Ph. D. dissertation, Pa. State Univ. 112p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

Heterosis was found to occur, for lengths and weights, in crosses among inbred lines of both brook trout and brown trout. High phenotypic correlations between means of inbreds and those of their line crosses and top crosses indicate the presence of general combining ability variance among brook trout lines. Inbreeding depression for egg and fry viability in brook trout and rainbow trout, and for growth in brook trout, as well as heterosis for length and weight in brook trout and brown trout, were considered as evidence for specific combining ability variance in the populations. Inbred lines of brook trout were found to contain, at maturity, a reduced number of males. These sex ratios were consistent and the ratio over all lines was about 3 females: 1 male. Aberrant sex ratios among inbred lines might be explained on the basis of selection at sex linked loci which would tend to decrease the fitness of the homogametic sex. The results would implicate the males as the homogametic sex in brook trout.--From abstr.

76-000406 Reisenbichler, R. R.; McIntyre, J. D. GENETIC DIFFERENCES IN GROWTH AND SURVIVAL OF JUVENILE HATCHERY AND WILD STEELHEAD TROUT, /SALMO GAIRDNERI/. J. Fish. Res. Board Can. 34 (1): 123-128. Jan. 1977. In English with French summ. SFA 22(2)

[Oreg. Dep. Fish Wildl., Res. Div., Corvallis 97330] Relative growth and survival of offspring from matings of hatchery and wild Deschutes River (Oregon) summer steelhead trout, /Salmo gairdneri/, were measured to determine if hatchery fish differ genetically from wild fish in traits that can affect the stock-recruitment relationship of wild populations. Sections of four natural streams and a hatchery pond were each stocked with genetically marked (lactate dehydrogenase genotypes) eyed eggs or unfed swim-up fry from each of three matings: hatchery X hatchery (HH), hatchery X wild (HW), and wild X wild (WW). In streams, WW fish had the highest survival and HW fish the highest growth rates when significant differences were found; in the hatchery pond, HH fish had the highest survival and growth rates. The hatchery fish were genetically different from wild fish and when they interbreed with wild fish may reduce the number of smolts produced. Hatchery procedures can be modified to reduce the genetic differences between hatchery and wild fish.

WARMWATER CULTURE

76-000407 Cabrereo, J. E., Jr. PRODUCTION OF CHANNEL CATFISH, /ICTALURUS PUNCTATUS/ (RAFINESQUE) IN A CLOSED SYSTEM WITH CIRCULATION, AERATION AND FILTRATION. Ph. D. dissertation, Auburn Univ. 141p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

76-000408 Carter, R. R.; Thomas, A. E. SPAWNING OF CATFISH IN TANKS. Prog. Fish-Cult. 39 (1): 13. Jan. 1977. SFA 22(2)
[U.S. FWS, Fish Farming Exp. Stn., Stuttgart, AR 72160]

76-000409 Cuff, W. R. INITIATION AND CONTROL OF CANNIBALISM IN LARVAL WALLEYES. Prog. Fish-Cult. 39 (1): 29-32. Jan. 1977. SFA 22(2)
[Minist. Conserv., Fish Wildl. Div., Melbourne, Victoria, Australia] Walleyes (/Stizostedion v. vitreum/) less than 20 days old attempt to be cannibalistic, irrespective of the presence of alternative food; however, well-fed walleye larvae of this age do not become the prey of other larval walleyes because their escape behavior enables them to avoid capture. On the other hand, walleyes more than 20 days old do not attempt to cannibalize if an alternative food source is available. Escape behavior which makes walleyes difficult to catch by other walleyes develops by 18 days of age. As walleyes become pregressively more difficult to capture by other walleyes, they are attacked less often.

76-000410 Padlan, P. G.; Poernomo, A.; Alikunhi, K. H. YEAR-ROUND, MULTIPLE CROPPING TO INCREASE PRODUCTION OF MILKFISH, /CHANOS CHANOS/, FROM SHALLOW, BRACKISH WATER PONDS. Bull. Shrimp Cult. Res. Cent. (Jepara) 1 (2): 79-98. July 1975. In English with Indonesian summ. SFA 22(2)
[UNDP/FAO, Shrimp Cult. Res. Cent., Jepara, Indonesia] Average annual production of milkfish in Java, Indonesia ranged from 132 kg/ha/yr in central Java to 297 kg/ha/yr in west Java during 1972. Improved methods of milkfish culture carried out at Jepara in four ponds, extending over 5.05 hectares, over a period of two and a half years and harvesting in all 20 crops, each of 2 to 3.5 month's duration, has given much higher yields ranging from 1,004.4 to 1,288.9 kg/ha/yr of milkfish. Improved methods adopted have been detailed. A 1.5 hectare pond unit comprising nursery, rearing and production ponds has been suggested as the smallest, viable, Subsistence production unit holding for central Java. Integrated production schedules for harvesting at least three marketable crops in a year from the above unit, yielding at least 1,500 kg. of milkfish has been furnished as a working calendar.

76-000411 Pretto Malca, R. POLYCULTURE SYSTEMS WITH CHANNEL CATFISH AS THE PRINCIPAL SPECIES. Ph. D. dissertation, Auburn Univ. 202p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)
Several polyculture systems utilizing the channel catfish as the principal species were evaluated over a two-year period in 0.1-acre earthen ponds. During 1974, channel catfish were stocked at 3000/A in combination with hybrid buffalofish at 100 adults or 1000 fingerlings/A, mirror carp at 50 or 100/A, and blue tilapia at 250 or 500 males and females/A, for 208 day growing period. Each experimental pond received the same amount of supplemental feed. Net yields of fish

76-000411 CONTINUED
ranged from 2694 lb/A with catfish alone to 4483 lb/A with a combination of catfish, buffalofish and tilapia. The only treatment that did not reduce channel catfish production was 250 tilapia/A, which added 180 lb/A of harvestable tilapia and 1000 lb/A of non harvestable tilapia to the 2700 lb/A of channel catfish. In 1975 grass carp was stocked in all ponds at 20/A. Silver carp, big head carp and largemouth bass were also added in different combinations to a standard stocking rate of channel catifsh (3000/A). The growing period was 211 days. Supplemental food was added equally to all ponds. Catfish growth (3083 lb/A in control treatment) was similar in ponds with buffalofish (50/A), those with tilapia (250 all male/A), and those with bighead carp (50/A). Catfish yield was increased in ponds with silver carp (100 & 1000/A). Catfish growth was depressed with combinations of 250 T-R (male and female tilapia with reproduction), 250 T-R + 200 largemouth bass/A and 250 T-R + 100 silver carp/A. Net yields of fish ranged from 3113 lb/A with a combination of catfish, grass carp and buffalofish to 4502 lb/A with a combination of catifsh, Grass carp and tilapia.--From abstr.

76-000412 Valenti, R. J. INDUCED POLYPLOIDY IN /TILAPIA AUREA/ (STEINDACHNER) BY MEANS OF TEMPERATURE SHOCK TREATMENT. J. Fish Biol. (4): 519-528. July 1975. SFA 22(2)
[N.Y. Ocean Sci. Lab., Dep. Ichthyol., Montauk 11954] A technique for increasing ploidy in the blue tilapia, /Tilapia aurea/, was investigated for the purpose of determining its effect on standard length. Gametes of /T. aurea/ were stripped from ripe adults and eggs were fertilized with donor sperm from several males. A description of the extra-oral incubation system used for the embryos is provided. This system resulted in a maximum of 90 percent successful hatch. Normal egg development was interrupted by immersion of newly fertilized eggs (15 min post-insemination) in cold or hot water for various durations. The reliability of these techniques for inducing polyploidy was examined using increased volume of erythrocyte nuclei as a criteria for success. A cold shock of from 32° C (ambient) to 11° C for a 1 h duration resulted in the largest incidence of polyploidy (75 percent). Polyploid fish were found to be larger than diploid siblings when measured at 14 weeks of age.

76-000413 Welykochatko, T. BIOLOGY OF THE CARP IN BRAZIL. Ann. Zool. (Agra) 12 (2): 53-65. Apr. 1976. SFA 22(2)
[Caixa postal 9815, Sao Paulo, Brazil] The carp is cultured mainly in the south half of Brazil by amateurs in small ponds and lakes, both natural and artificial, the productivity of which is extremely restricted. There are no large hatcheries which could breed carps in large numbers for commercial purposes, although the climatic and hydrological conditions in Brazil are very favorable for carp cultivation in rivers, large and small lakes, and ponds. Experiments prove that even under unfavourable conditions of the small oligotrophic and distrophic reservoirs, the carp survives comparatively well. In such reservoirs, the carps reveal in their biological and ecological properties specific features of eurybiont fishes which are especially marked in their propagation, fertility, nutrition, and growth. The present observations seem to justify the inference that the revealed biological specifics of the carp in Brazil are caused manily by the phenomena of heterosis and of the diurnal temperature variations in the Brazilian climate.--From abstr.

FEEDS, FEEDING AND NUTRITION

76-000414 Atherton, W. D. THE EFFECT OF DIFFERENT LEVELS OF DIETARY FAT ON THE GROWTH OF RAINBOW TROUT (/SALMO GAIRDNERI/ RICHARDSON). J. Fish Biol. 7 (5): 565-571. Sept. 1975. SFA 22(2)
[Sci. Dep., Stockport Tech. Coll., Stockport, Cheshire, England] Two types of fat, represented by cod liver oil and lard, were added at various levels to the diet of rainbow trout. The food intake of the trout and their growth rate were measured. The results indicated that when cod liver oil was used as the fat supplement, the amount and the water temperature affected food intake and weight gain; fish fed on lard showed only a slight loss of appetite.

76-000415 Briggs, P. T. EFFECT OF FEEDING CANNED KERNEL CORN ON THE CONDITION OF WINTER FLOUNDER. N.Y. Fish Game J. 24 (1): 86-90. Jan. 1977. SFA 22(2)
[N.Y. State Dep. Environ. Conserv., Albany 12201] Canned kernel corn was fed to winter flounders to simulate the chum used in the sport fishery. Corn constituting up to 80 per cent of the diet neither altered the condition factor nor killed the fish.

76-000416 de la Higuera, M.; Murillo, A.; Varela, G.; Zamora, S. EFECTO DE LA DIETA SOBRE LA COMPOSICION EN ACIDOS GRASOS DE LA TRUCHA (/SALMO GAIRDNERII/). [DIET EFFECT ON FATTY ACIDS COMPOSITION IN TROUT (/SALMO GAIRDNERII/).] Rev. esp. Fisiol. 32: 317-322. 1976. In Spanish with English summ. SFA 22(2)
[Dep. Fisiol., Fac. Vet., Ciudad Univ., Madrid-3, Spain] The effect of diets with different fatty acids composition on muscular and hepatic fatty acids of rainbow trout (/Salmo gairdnerii/) was studied. The effect was higher on muscular fatty acids than on hepatic ones. The lack of correlation between dietary and liver fatty acids in diets with a high level of linoleic acid, showed a better utilization of this acid by the liver. The change in muscular fatty acids pattern was observed within a week of diet change, showing a significant tendency to approach the new dietary fatty acids pattern.

76-000417 Fagerlund, U. H. M.; McBride, J. R. GROWTH INCREMENTS AND SOME FLESH AND GONAD CHARACTERISTICS OF JUVENILE COHO SALMON RECEIVING DIETS SUPPLEMENTED WITH 17ALPHA-METHYLTESTOSTERONE. J. Fish Biol. 7 (3): 305-314. May 1975. SFA 22(2)
[Dep. Environ., Fish. Mar. Serv., Vancouver Lab., West Vancouver, BC, Canada] Juvenile coho salmon /Oncorhynchus kisutch/ (Walbaum) received a diet of Oregon Moist Pellets supplemented with either 10, 1, 0.2 or 0 ppm of 17alpha-methyltestosterone for 72 weeks. The fish were held in fresh water during the first 57 weeks and in salt water during the remaining time of the study. At the end of the fresh water residency, the fish receiving 10 and 1 ppm of steroid showed a net increase in weight of 125 and 71 percent respectively over the controls. Both test groups also gained in length, but the 10 ppm group gained proportionately less, which resulted in a thicker body. After transfer to salt water at the normal time of smolting, there was a decrease in the rate of growth in weight and length of the two groups receiving the high doses of steroid. The decrease was most noticeable in the 10 ppm group and a number of mortalities occurred in this group. Testes of fish receiving 10 ppm of the steroid became hypertrophied and later degenerated with loss of spermatogonia; the ovaries were not affected. 17alpha-methyltesterone fed at 10 ppm for 49 weeks increased the lipid content of the flesh from 2.4 to 3.5

76-000417 CONTINUED
percent and decreased the amount of flesh from 35.0 to 28.5 percent of body weight. No change in the moisture content was found. External changes noted in the 10 ppm group included loss of silvering, deepening of the body, particularly in the region of the anal fin, and widening of the lower jaw.

76-000418 Garling, D. L., Jr.; Wilson, R. P. EFFECTS OF DIETARY CARBONHYDRATE-TO-LIPID RATIOS ON GROWTH AND BODY COMPOSITION OF FINGERLING CHANNEL CATFISH. Prog. Fish-Cult. 39 (1): 43-47. Jan. 1977. SFA 22(2)

[Dep. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061] Eight isonitrogenous, isocaloric semipurified diets were formulated with varying levels of digestible carbohydrate (white dextrin) and lipid (salmon-oil--corn-oil mixture) to determine the effect of each as energy sources for fingerling channel catfish (/Ictalurus punctatus/). After an initial 2-wk conditioning period, the experimental diets were fed in triplicate to groups of channel catfish fingerlings weighing 201 ±2 g per 110-liter flow-through aquarium. The diets were fed at a rate of 3 percent of the total wet weight of fish per day, divided into three equal feedings and adjusted weekly for 9 weeks. At the end of the feeding period no significant differences were observed in the growth rates, feed conversion, protein depositon, or energy retention of fish fed diets containing carbohydrate-to-lipid ratios (CHO:L) of 0.45 to 4.5. The observed effects of dietary CHO:L ratio on liver histology and on liver and carcass composition had no adverse effects on growth rates or feed conversion. These data indicate that digestible carbohydrates can be effectively used by channel catfish and can be substituted for lipids in semipurified diets at a rate commensurate with standard physiological fuel values of 2.25:1 within this CHO:L range.

76-000419 Garling, D. L., Jr. THE OPTIMUM DIETARY CALORIE TO PROTEIN RATIO FOR CHANNEL CATFISH FINGERLINGS, /ICTALURUS PUNCTATUS/. Ph. D. dissertation, Miss. State Univ. 134p. 1975. From Diss. Abstr. Int. B Sci. Eng. 36(11), 1976. SFA 22(2)

Twenty-one semipurified experimental diets were formulated with seven different crude protein levels and three different energy levels at each protein level to determine the optimum calorie to protein (C/P) ratio for channel catfish fingerlings. This study indicated that the concept of C/P ratios must be restricted to diets containing adequate levels of protein and ME. Deits containing energy levels between 275 and 341 ME appeared to have an optimum dietary C/P ratio of approximately 11.4 for channel catfish fingerlings. A significant increase in average daily gain (P less than 0.05) was observed in fish fed diets containing up to 24.06 percent crude protein at 275 ME and approximately 30 percent crude protein at 341 ME (both approximately 11.4 C/P). Feed conversion and feed efficiency ratios were maximized by diets containing 24.06 percent crude protein at 275 ME and 25 percent crude protein at 341 ME. Diets containing 24.06 percent crude protein and 275 ME produced fish with a significantly higher percent protein deposited than those fed diets consisting of 28 or 32 percent crude protein and 341 ME. It would appear that a diet containing 24 percent crude protein and 275 ME would produce fish more efficently in terms of average daily gain and percent protein deposited.--From abstr.

TRANSPORTING FISH

76-000420 Hattingh, J.; Le Roux Fourie, F.; van Vuren, J. H. J. THE TRANSPORT OF FRESHWATER FISH. J. Fish Biol. 7 (4): 447-449. July 1975. SFA 22(2)

[Dep. Zool., Rand Afrikaans Univ., Johannesburg, South Africa] A method is described for the transport of fish resulting in very few or no mortalities during or after this procedure. Commercial salt is added to the water to give a final concentration of 0.5 percent, compressed air is bubbled through the water and the fish are kept in 'salt water' after transportation to decrease the incidence of skin infections.

AQUARIUMS

76-000421 McCosker, J. E.; Anderson, M. E. AQUARIUM MAINTENANCE OF MESOPELAGIC ANIMALS: A PROGRESS REPORT. Bull. South. Calif. Acad. Sci. 75 (2): 211-219. Aug. 1976. SFA 22(2)

[Steinhart Aquarium, Calif. Acad. Sci., San Francisco 94118] Literature and experiments in progress concerning the capture and aquarium maintenance of midwater fishes and invertebrates are discussed. The longevity and survival of mesopelagic animals captured in Monterey Bay, California, are tabulated, and those species which appear most suitable for aquarium captivity are identified. Certain mesopelagic species are insensitive to large changes in hydrostatic pressure and were maintained at ambient pressure with proper temperature and light controls.

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

76-000422 Gale, W. F. MINIATURE AQUARIUM SYSTEM FOR REARING SMALL NUMBERS OF FISH LARVAE. Prog. Fish-Cult. 39 (1): 10-13. Jan. 1977. SFA 22(2)

[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603] Eggs of 19 species of river fish were hatched and the larvae reared in small aquariums flushed with swimming-pool water. The simple construction of the aquarium system kept costs low and allowed the use of simplified feeding methods. Size and structure of the system can easily be altered to meet changing needs.

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

76-000423 Simmons, D. B. THE GEOMORPHIC AND HYDRAULIC RESPONSE OF RIVERS. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 209-219. 1975. SFA 22(2)

[Coll. Eng., Colo. State Univ., Ft. Collins 80523]

BENTHOS

76-000424 Flint, R. W.; Goldman, C. R. CRAYFISH GROWTH IN LAKE TAHOE: EFFECTS OF HABITAT VARIATION. J. Fish. Res. Board Can. 34 (1): 155-159. Jan. 1977. In English with French summ. SFA 22(2)

[Great Lakes Lab., State Univ. Coll., Buffalo, NY 14222] The natural history and ecology of the freshwater crayfish /Pacifastacus leniusculus/ was investigated in Lake Tahoe for 1 yr. Growth of individual groups varied between three different transects (I, II, and III). The mean size of carapace of adult crayfish trapped on Transects II and III was greater than those trapped at Transect I. Linear regression analyses of premolt-postmost carapace length revealed similar differences. At the onset of sexual maturity females from Transect I were smaller than those from either Transect II or III. Examination of physical and biological parameters in the benthic habitat revealed that food availability, amount of shallow water, and size and area of stone cover influenced the number and size of adult crayfish on each transect. Greater food availability and more extensive stone cover on the lake bottom attracted higher numbers of crayfish to Transect I. The result was overcrowding and competition for food and larger stone cover for larger adults. The effect was a slower growth rate of crayfish on Transect I compared with animals on either of the other transects.

76-000425 Ward, J. V. LUMBRICID EARTHWORM POPULATIONS IN A COLORADO MOUNTAIN RIVER. Southwest. Nat. 21 (1): 71-78. 20 Mar. 1976. SFA 22(2)

[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] A large population of /Eiseniella tetraedra/, a lumbricid earthworm, was located in a rubble riffle in a Colorado mountain river, where it comprised an important part of the benthic fauna. With the exception of low mid-winter values, the standing crop exhibited a general increase following spring runoff, reaching a maximum of 291 individuals and 17.2 g/m^2 in April of the following year. The worms were eliminated by a severe flood in May and had not completely recolonized the riffle nearly one year later. An exchange mechanism apparently exists between the riffle and the stream banks, with the riffle serving as a refuge in cold weather and the banks acting as a population reservoir. There is evidence that smooth current, relatively constant flow, and higher than normal winter water temperatures account for the presence of this lumbricid earthworm in a mountain stream habitat.

PLANKTON

76-000426 Brinton, E. POPULATION BIOLOGY OF /EUPHAUSIA PACIFICA/ OFF SOUTHERN CALIFORNIA. NOAA Fish. Bull. 74 (4): 733-762. Oct. 1976. SFA 22(2)

[Scripps Inst. Oceanogr., La Jolla, CA 98093] /Euphausia pacifica/ was observed with respect to reproduction, growth and development of cohorts, and successions in population structure and biomass during 4 yr, 1953-56. The southern California eddy and its upwelling regime serve as a reproduction refuge for a warm-temperate population of this euphausiid. Three size classes spawn there during a year--the largest in April-June, an intermediate in June-February, and small, newly mature females usually in August-January. There were year-to-year differences. The largest densities of larvae were observed about a

76-000426 CONTINUED
month after egg peaks (one survey later) or appeared coincident with them. Growth was estimated to be about 3 mm body length per month, slowing during September-January or after about 17 mm. Females appeared to grow slower in breeding seasons. Maturity can be at 11 mm, but reproduction is not general until 15-16mm. Survivorship was lowest for furcilia larvae, increased in juvenile and young adult phases, then decreased after reproduction became regular. Slowed growth and increased survivorship at life interphases appeared to cause regular frequency and biomass maxima at lengths of 7, 10-12, and 15 mm. Sex ratio favored females. Males apparently accomplished multiple fertilizations.--From abstr.

76-000427 Rothlisberg, P. C.; Pearcy, W. G. AN EPIBENTHIC SAMPLER USED TO STUDY THE ONTOGENY OF VERTICAL MIGRATION OF /PANDALUS JORDANI/ (DECAPODA, CARIDEA). NOAA Fish. Bull. 74 (4): 994-997. Oct. 1976. SFA 22(2)
[CSIRO, Div. Fish Oceanogr., North East Reg. Lab., Cleveland, Queensland, 4163, Australia]

76-000428 Youngbluth, M. J. VERTICAL DISTRIBUTION AND DIEL MIGRATION OF EUPHAUSIIDS IN THE CENTRAL REGION OF THE CALIFORNIA CURRENT. NOAA Fish. Bull. 74 (4): 925-936. Oct. 1976. SFA 22(2)
[Harbor Br. Found. Lab., RFD 1, Box 196, Fort Pierce, FL 33450] The density, vertical range, and diel movement of total zooplankton and euphausiid populations in the central region of the California Current were determined during a period of coastal upwelling, July-August 1970. Collections were made along four transects with opening-closing Bongo nets towed through 50- to 100-m intervals in the upper 800 m. Four- to nine-depth intervals at 13 day-night stations were sampled. Twenty euphausiid species from seven genera were identified from 124 hauls. Zooplankton assemblages in the nearshore regions differed from those farther offshore in having a larger biomass as well as a smaller number and higher density of several species. Diel vertical movement among euphausiid populations, particularly /Euphausia pacifica/, tended to be more pronounced in offshore waters. This behavior suggests that, although assemblages of zooplankton are strongly structured by physical factors, some species alter their vertical distribution and diel migration, presumably in response to the prevailing food supply.

MORPHOLOGY

76-000429 Anderson, W. C.; Manion, P. J. MORPHOLOGICAL DEVELOPMENT OF THE INTEGUMENT OF THE SEA LAMPREY, /PETROMYZON MARINUS/. J. Fish. Res. Board Can. 34 (1): 159-163. Jan. 1977. In English with French summ. SFA 22(2)
[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855] The thickness of the ventral body wall of the sea lamprey (/Petromyzon marinus/) increased 117 percent from June through January, and decreased 14 percent from January through May. During these respective periods, length increased 93 percent and decreased about 11 percent. Our studies suggest that the loss in length is part of the natural cycle; possibly prespawning adults cease feeding, or feed at a greatly reduced rate, beginning as early as January, rather than in March or April, as previously believed.

76-000430 Berkovitz, B. K. B.; Moore, M. H. TOOTH REPLACEMENT IN THE UPPER JAW OF THE RAINBOW TROUT (/SALMO GAIRDNERI/). J. Exp. Biol. 193 (2): 221-234. Aug. 1975. SFA 22(2)
[Dep. Anat., Med. Sch., Univ. Bristol, University Walk, Bristol BS8 1TD, England]

76-000431 Denoncourt, R. F.; Robbins, T. W.; Stauffer, J. R., Jr. A DESCRIPTION OF XANTHIC TESSELLATED DARTERS, /ETHEOSTOMA OLMSTEDI/ (TELEOSTEI: PERCIDAE). Copeia. 1976 (4): 813-815. 30 Dec. 1976. SFA 22(2)
[York Coll. Pa., York, PA 17405]

76-000432 Fay, R. R.; Popper, A. N. MODES OF STIMULATION OF THE TELEOST EAR. J. Exp. Biol. 62 (2): 379-387. Apr. 1975. SFA 22(2)
[Bowman Gray Sch. Med., Wake Forest Univ., Winston-Salem, NC 27103] Microphonic potentials were recorded from the inner ears of a catfish (/Ictalurus punctatus/) and an African mouthbreeder (/Tilapia macrocephala/) in response to underwater sound stimulation and direct vibration of the head. The shape of the vibratory isopotential functions of frequency was similar in both species up to 600 Hz. Above 600 Hz, the sensitivity of /Ictalurus/ continued to increase to 4000 Hz while the sensitivity of /Tilapia/ declined. Deflation of the swim bladder did not affect the response to vibration in either species, the response of /Tilapia/ to the underwater sound stimulus being minimal and unaffected by removal of the swim bladder. /Ictalurus/ was pressure-sensitive to above 4000 Hz, there being a significant decline in the response with deflation of the swimbladder.--Summ.

76-000433 Greer-Walker, M.; Pull, G. A. A SURVEY OF RED AND WHITE MUSCLE IN MARINE FISH. J. Fish Biol. 7 (3): 295-300. May 1975. SFA 22(2)
[Fish. Lab., Lowestoft, Suffolk, England] The proportion of the myotomal muscle that comprises red or slow muscle fibres was assessed histologically for 84 species of marine fish. The results are discussed in relation to their mode of life.

76-000434 Hickey, C. R., Jr.; Young, B. H.; Bishop, R. D. SKELETAL ABNORMALITIES IN STRIPED BASS. N.Y. Fish Game J. 24 (1): 69-85. Jan. 1977. SFA 22(2)
[U.S. Nuclear Regulatory Comm., Environ. Specialists Br., Washington, DC 20555] Many types of skeletal anomalies have been reported to exist in fishes, but only one type, pugheadedness, have been previously reported for wild striped bass. The present paper describes 23 anomalous striped bass (ranging in year class from 1964 to 1973) collected during 1973 from localities around Long Island (N.Y.). Pugheadedness was observed in eight adult and six young-of-the-year fish, and four abnormal conditions heretofore unreported for wild striped bass are described: cross-bite, lordosis, scoliosis and abnormal fins. The occurrence of abnormal conditions among hatchery-reared striped bass X white bass hybrids is also noted. Anomalous striped bass are probably more numerous than previous reports tend to indicate. However, all the wild fish examined appeared capable of survival.

76-000435 Ingram, J. K.; Reno, H. W. ULTRASTRUCTURE OF THE INFRAORBITAL AND PREOPERCULOMANDIBULAR CANAL NEUROMASTS OF THE SILVERJAW MINNOW, /ERICYMBA BUCCATA/ (PISCES: CYPRINIDAE). Southwest. Nat. 20 (4): 445-459. 10 Jan. 1976. SFA 22(2)
[H. W. Reno: Williams Bros., Environ. Serv., Tulsa, OK 74136]

76-000436 Kryvi, H. THE STRUCTURE OF THE EMBRYONIC EXTERNAL GILL FILAMENTS OF THE VELVET BELLY SHARK /ETMOPTERUS SPINAX/. J. Zool. (Lond.) 180 (2): 253-261. Oct. 1976. SFA 22(2)
[Inst. Anat., Univ. Bergen, Aarstadvollen, N-5000, Bergen, Norway]
The purely embryonic external gill filaments of sharks consist of a single capillary loop, covered by a two-layered epithelium with short microvilli. Towards the end of the embryonic period, the epithelial cells are filled with fibrils, about 10 nm in diameter, and mitochondria, endoplasmic reticulum and Golgi bodies disappear. The basal lamina increases in thickness, and collagen fibrils accumulate beneath. Numerous dense vesicles appear in the endothelial cells.

76-000437 Lesseps, R. J.; Geurts van Kessel, A. H. M.; Denuce, J. M. CELLPATTERNS AND CELL MOVEMENTS DURING EARLY DEVELOPMENT OF AN ANNUAL FISH, /NOTHOBRANCHIUS NEUMANNI/. J. Exp. Zool. 193 (2): 137-146. Aug. 1975. SFA 22(2)
[Dep. Biol. Sci., Loyola Univ., New Orleans, LA 70118]

76-000438 Lowe, G. A.; MacLeod, N. K. THE ULTRASTRUCTURAL ORGANIZATION OF OLFACTORY EPITHELIUM OF TWO SPECIES OF GADOID FISH. J. Fish Biol. 7 (4): 529-532. July 1975. SFA 22(2)
[Gatty Mar. Lab., The University, St. Andrews KY16 8LB, Scotland]
The untrastrucutural organization of the olfactory epithelium of the cod /Gadus morhua/ (L.) and the haddock /Melanogrammus aeglefinus/ (L.) was studied using both transmission and scanning electron microscopy. The olfactory rosette was found to exhibit regional differences; the faces of the olfactory lamella were composed of sensory epithelium, the edges were non-sensory. The cellular organization of the olfactory epithelium was determined and consisted of bi-polar sensory neurones, supporting cells, mucous cells and basal cells. The ultrastructure of the sensory cells was consistent, having an elongate cell, the free surface of which terminated in an olfactory vesicle from which arose either four olfactory cilia or numerous microvilli. Ciliary aggregations have been found in the two species of gadoid fish studied; it is suggested that these structures aid in the separation and in the circulation of fluid between the lamellae. The surface structure of the supporting cells was found to be of two types: either ciliated or ridged; the former presenting distinct ciliated tufts, the latter showing definite, but unorgainzed, ridges over the epithelium surface.

76-000439 Morris, S. L.; Gaudin, A. J. THE CRANIAL OSTEOLOGY OF /AMPHISTICHUS ARGENTEUS/ (PICES: EMBIOTOCIDAE). Bull. South. Calif. Acad. Sci. 75 (1): 29-38. May 1976. SFA 22(2)
[Dep. Biol., Calif. State Univ., Northridge 91234]

76-000440 Obika, M. THE CHANGES IN CELL SHAPE DURING PIGMENT MIGRATION IN MELANOPHORES OF TELEOST, /ORYZIAS LATIPES/. J. Exp. Zool. 191 (3): 427-432. Mar. 1975. SFA 22(2)
[Dep. Biol., Keio Univ., Yokohama 223, Japan]

76-000441 Parvatheswararao, V. DISTRIBUTION OF VISUAL PIGMENTS IN THE TELEOSTEI--A COMMENT. Mar. Biol. 33 (1): 67-70. 10 Nov. 1975. SFA 22(2)
[Dep. Zool., Sri Venkateswara Univ., Tirupati, India]

76-000442 Priede, I. G. FUNCTIONAL MORPHOLOGY OF THE BULBUS ARTERIOSUS OF RAINBOW TROUT (/SALMO GAIRDNERI/ RICHARDSON). J. Fish Biol. 9 (3): 209-216. Sept. 1976. SFA 22(2)
[Dep. Zool., Univ. Aberdeen, Aberdeen, Scotland] The rate of expansion in volume of the bulbus arteriosus with increase in pressure is measured. From this it is calculated the elastic rebound of the bulbus can account for approximately 25 percent of blood flow in the ventral aorta; this proportion decreases as cardiac output increases. The structure of the wall of the bulbus is shown to consist of a compact outer layer with a series of separate longitudinal elements on the inner surface. These elements are connected to the compact layer by numerous radial fibres. This structure equalizes strain in all the structural elements of the wall during large changes in volume. Evidence is discussed which shows that the bulbus arteriosus in teleosts in morphologically and biochemically distinct from the ventral aorta. The bulbus is probably of cardiac origin rather than an expansion of the posterior end of the aorta as generally supposed.

76-000443 Resh, V. H.; White, D. S.; Elbert, S. A.; Jennings, D. E.; Krumholz, L. A. VERTEBRAL VARIATION IN THE EMERALD SHINER /NOTROPIS ATHERINOIDES/ FROM THE OHIO RIVER: AN APPARENT CONTRADICTION TO "JORDAN'S RULE." Bull. South. Calif. Acad. Sci. 75 (2): 76-84. Aug. 1976. SFA 22(2)
[Div. Entomol. Parasitol., Univ. Calif., Berkeley 94720] Vertebral numbers of the emerald shiner /Notropis atherinoides/ collected from approximately 100-mile intervals of the Ohio River during 1957-1959 were analyzed using x-rays. Counts ranged from 36 to 42 with an overall mean of 39.58 vertebrae. There was a consistent gradual cline in numbers of vertebrae with significant differences in mean numbers. Numbers were smallest near the source and largest near the mouth of the river. This is a reversal of the usual trend of greater numbers of vertebrae at higher latitudes, but it may be consistent with Jordan's Rule in that habitats in the upper (more northerly) reaches of the river may warm more quickly, and embryonic development may proceed there at higher temperatures than in the lower reaches.

76-000444 Roberts, T. R. CHARACOID FISH TEETH FROM MIOCENE DEPOSITS IN THE CUENCA BASIN, ECUADOR. J. Zool. (Lond.) 175 (2): 259-271. Feb. 1975. SFA 22(2)
[Mus. Comp. Zool., Cambridge, MA] Miocene deposits from the Cuenca Basin in the Ecuadorean Andes (elevation 2360 to 2920 m) yield teeth belonging to four of the 12 neotropical families of characoid fishes: Erythrinidae, Characidae, Anostomidae, and Parodontidae. Previous characoid fossil records exist only for Characidae and Curimatidae. The erythrinid teeth are indistinguishable from those of /Hoplias/. Except for one tooth which belongs to Myleinae, the characid teeth are similar to those in many small to moderately large living members of the Tetragonopterinae. The anostomid jaw teeth belong to /Leporinus/. Pharyngeal teeth of typical anostomid appearance are referred to

76-000444 CONTINUED
/Leporinus/. The parodontid teeth cannot be identified to genus with certainty but may belong to /Parodon/. Parodontidae indicate a mountain stream habitat.

76-000445 Shellis, R. P.; Berkovitz, B. K. B. OBSERVATIONS ON THE DENTAL ANATOMY OF PIRANHAS (CHARACIDAE) WITH SPECIAL REFERENCE TO TOOTH STRUCTURE. J. Zool. (Lond.) 180 (1): 69-84. Sept. 1976. SFA 22(2)
[M.R.C. Dental Unit, Dental Hosp., Lower Maudlin St., Bristol, England] A study of the tissues of the teeth and jaws in piranhas, using the scanning electron microscope and various techniques of light microscopy, revealed many dental adaptations related to the specialized feeding habits of these carnivorous fishes. The dentition is primarily sectorial, although some anterior teeth may be used in grasping. The scissor-like rows of teeth are maintained by the specialized pattern of tooth replacement. The bones of the jaws and the tooth attachment support the teeth very firmly. In its structural organization, the enameloid covering the teeth closely resembles that on the sectorial teeth of sharks and is adapted to the probable stress patterns set up in biting.

76-000446 Williams, R. W.; Warner, M. C. SOME OBSERVATIONS ON THE STAINED BLOOD CELLULAR ELEMENTS OF CHANNEL CATFISH, /ICTALURUS PUNCTATUS/. J. Fish Biol. 9 (6): 491-497. Dec. 1976. SFA 22(2)
[Health Sci. Prog., Ark. Coll., Batesville, 72501] Slides were prepared from blood of channel catfish, /Ictalurus punctatus/, and evaluated. The cellular blood elements observed were thrombocytes, lymphocytes, neutrophils, monocytes, eosinophils, basophils, granular anucleate bodies, erythrocytes. In channel catfish, thrombocytes, lymphocytes and neutrophils were the predominate leucocytes. Erythrocytes were observed in various stages of development. Smudge cells were observed in all smear preparations. The variations found between the observations in this study and information provided in the literature suggest the need for establishing a standardized terminology.

76-000447 Wisner, R. L. NEW DATA ON THE RARE ALEPOCEPHALID FISH /PHOTOSTYLUS PYCNOPTERUS/. Bull. South. Calif. Acad. Sci. 75 (2): 153-158. Aug. 1976. SFA 22(2)
[Scripps Inst. Oceanogr., Mar. Biol. Res. Div., La Jolla, CA 92093] New data are given on the unique and infrequently reported mesopelagic alepocephalid fish /Photostylus pycnopterus/. The second figure of the species and the first figure of its distribution are presented. The new information involves, principally, the superficial structure of the stalked luminous organs and paired intermandibular flaps, numbers of gill rakers on all arches, and dentition; teeth of the premaxillary, maxillary and mandible increase in number with size of fish. All captures (17), excepting possibly two, were made within distinctly warm-water regions, and about half were made over or very near rather steeply inclined topography, the remainder over abyssal plains. Also, all captures except one are from areas of rather high productivity.

76-000448 Woolcott, W. S.; Kirk, W. L. MELANISM IN /LEPISOSTEUS OSSEUS/ FROM THE JAMES RIVER, VIRGINIA. Copeia. 1976 (4): 815-817. 30 Dec. 1976. SFA 22(2)
[Dep. Biol., Univ. Richmond, Richmond, VA 23173]

76-000449 Yamamoto, M.; Iuchi, I. ELECTRON MICROSCOPIC STUDY OF ERYTHROCYTES IN DEVELOPING RAINBOW TROUT, /SALMO GAIRDNERII IRIDEUS/, WITH PARTICULAR REFERENCE TO CHANGES IN THE CELL LINE. J. Exp. Zool. 191 (3): 407-426. Mar. 1975. SFA 22(2)
[Zool. Inst., Fac. Sci., Univ. Tokyo, Bunkyo-ku, Tokyo, Japan 113]

PHYSIOLOGY

76-000450 Atz, J. W.; Smith, C. L. HERMAPHRODITISM AND GONADAL TERATOMA-LIKE GROWTHS IN STURGEON (/ACIPENSER/). Bull. South. Calif. Acad. Sci. 75 (2): 119-126. Aug. 1976. SFA 22(2)
[Am. Mus. Nat. Hist., New York, NY 10024]

76-000451 Barlow, G. W. ON THE SOCIOBIOLOGY OF SOME HERMAPHRODITIC SERRANID FISHES, THE HAMLETS, IN PUERTO RICO. Mar. Biol. 33 (4): 295-300. Dec. 1975. SFA 22(2)
[Dep. Zool. Mus. Vert. Zool., Univ. Calif., Berkeley] Three species of hamlets, /Hypoplectrus chlorurus/, /H. unicolor/, and /H. puella/ (Pisces: Serranidae) were observed underwater off the west coast of Puerto Rico. They are predaceous fishes, feeding on small benthic organisms, and live in close association with the coral reef. Hamlets are highly aggressive and defend large territories, excluding their own and all other species of hamlets. They are synchronous hermaphrodites. In spawning, which occurs around sunset, one member of the pair ascends, the other joins it, each clasps the nape of the other with its tail, and gametes are released. Little color change occurs, but the black marking before the eye of /H. unicolor/ fades when fixing on prey, proving it is not used as a sighting line. The all-black nominal species /H. nigricans/ spawns with the yellow-tailed /H. chlorurus/, and is regarded here as a synonym of /H. chlorurus/.

76-000452 Butler, P. J.; Taylor, E. W. THE EFFECT OF PROGRESSIVE HYPOXIA ON RESPIRATION IN THE DOGFISH (/SCYLIORHINUS CANICULA/) AT DIFFERENT SEASONAL TEMPERATURES. J. Exp. Biol. 63 (1): 117-130. Aug. 1975. SFA 22(2)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, Birmingham, B15 2TT, England] Dogfish were acclimated to 7, 12 or 17°C and exposed to progressive hypoxia at the temperature to which they had been acclimated. Progressive hypoxia had no effect on heart rate or oxygen uptake at 7°C, whereas at 12°C and 17°C there was bradycardia, and a reduction in O(2) uptake, with the critical oxygen tension for both variables being higher at the higher temperature. Cardiac stroke volume increased during hypoxia at each temperature, such that cardiac output did not change significantly at 12 and 17°C. The significance of the present results with respect to the functioning and location of oxygen receptors is discussed. It is argued that as the metabolic demand and critical oxygen tension of the whole animal are increased at high acclimation temperatures the same must be the case with the oxygen receptor.--From summ.

76-000453 Caprio, J. T. OLFACTORY AND GUSTATORY RESPONSES OF CATFISH TO AMINO ACIDS AND DERIVATIVES. Ph. D. dissertation, Fla. State Univ. 270p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

The major purpose of this study was to compare electrophysiologically the olfactory and gustatory responses of catfish to amino acids and related compounds in terms of sensitivity, response range, and chemoreceptive specificity. Extracellular electrical recordings of olfactory and gustatory responses of catfish revealed that both chemosensory systems are highly sensitive to the alpha-amino acids. However, this sensory overlap does not reflect a simple duplication of receptor function as these chemical systems differ with regard to phasic-tonic response characteristics, thresholds and relative amino acid effectiveness. Chemoreceptive specificity was determined with a number of amino acids and derivatives tested on the various species of catfishes. Although specific differences were noted, the similarity among the species' responses to amino acids was clearly evident, suggesting that both olfaction and taste are evolutionally conservative systems. A major difference between the two chemosensory systems involved the amino acid side chain. With one exception, the taste system was highly responsive to the amino acids having lower molecular weight, unbranched and uncharged side chains, with L-alanine the most effective compound. The olfactory system was responsive to a group of amino acids that had side chains that were unbranched and uncharged, but were of generally higher molecular weight than found for taste. Single unit analysis has revealed that catfish gustuatory fibers can be classified into at least two categories, alanine-best and arginine-best units. Using both microelectrode recording techniques and scanning electron microscopy, the receptor area of the olfactory lamellae was located and described as a descreet sensory patch situated on each lamella adjacent to the midline of the olfactory capsule.--From abstr.

76-000454 Caulton, M. S. THE ABILITY OF THE CICHLID FISHES /TILAPIA RENDALLI/ BOULENGER, /TILAPIA SPARRMANII/ A. SMITH AND /HEMIHAPLOCHROMIS/ (= /PSEUDOCRENILABRUS/) /PHILANDER/ (M. WEBER) TO ENTER DEEP WATER. J. Fish Biol. 7 (4): 513-517. July 1975. SFA 22(2)

[Hydrobiol. Res. Unit, Biol. Sci., Univ. Rhodesia, Box MP 167, Salisbury, Rhodesia] It was shown experimentally that at 22° C, adult /Tilapia rendalli/ can descend to a maximum compensation depth of 8.5 m and that /Tilapia sparrmanni/ penetrate to a maximum depth of 15 m. Adult /Hemihaplochromis philander/ males can descend to 16 m, and females to 26 m at 22° C. At 30° C, the rate at which pressure compensation occurred and the maximum depth reached was increased. Fry and juveniles were able to penetrate to greater depths and to descend more rapidly than adults.

76-000455 Chan, D. K. O.; Chow, P. H. THE EFFECTS OF ACETYLCHOLINE, BIOGENIC AMINES AND OTHER VASOACTIVE AGENTS ON THE CARDIOVASCULAR FUNCTIONS OF THE EEL, /ANGUILLA JAPONICA/. J. Exp. Zool. 196 (1): 13-26. Apr. 1976. SFA 22(2)

[Dep. Zool., Univ. Hong Kong, Hong Kong]

76-000456 Claridge, P. N.; Potter, I. C. OXYGEN CONSUMPTION, VENTILATORY FREQUENCY AND HEART RATE OF LAMPREYS (/LAMPETRA FLUVIATILIS/) DURING THEIR SPAWNING RUN. J. Exp. Biol. 63 (1): 193-206. Aug. 1975. SFA 22(2)

[Sch. Biol. Sci., Univ. Bath, Claverton Down, Bath, BA2 7A7, England] The standard rate of oxygen consumption, ventilatory frequency and heart rate of adult /Lampetra fluviatilis/ were measured during the light phase of the photoperiod and at times corresponding to various stages in the upstream migration. All three parameters increased during the spawning run but only in mature individuals were signivicant differences found between the sexes. The regression coefficients for the logarithmic relationships between oxygen consumption and body weight of immature animals were 0.912 and 0.925 at 9.5 and 16°C respectively. Both the standard rate of oxygen consumption and the amount of oxygen taken up during activity increased greatly during the hours of darkness. Oxygen consumption, ventilatory frequency and, to a lesser extent, heart rate increased significantly at 9.5°C over the 100-20 percent range of saturation with air. Below 20 percent saturation with air, lampreys no longer remained attached by their oral disc for prolonged periods and the ventilatory frequency rose even more rapidly to reach a maximum of 175 beats/min at 12.5 percent. Exposure to 7.5 percent resulted in death within 5-8 h.--Summ.

76-000457 de Renzis, G. THE BRANCHIAL CHLORIDE PUMP IN THE GOLDFISH /CARASSIUS AURATUS/: RELATIONSHIP BETWEEN CL /HCO(3) AND CL /CL EXCHANGES AND THE EFFECT OF THIOCYANATE. J. Exp. Biol. 63 (3): 587-602. Dec. 1975. SFA 22(2)

[Zool. Stn., Comm. l'Energie Atomique, 06230 Villefranche-sur-Mer, France]

76-000458 de Vlaming, V. L.; Sage, M.; Tiegs, R. A DIURNAL RHYTHM OF PITUITARY PROLACTIN ACTIVITY WITH DIURNAL EFFECTS OF MAMMALIAN AND TELEOSTEAN PROLACTIN ON TOTAL BODY LIPID DEPOSITION AND LIVER LIPID METABOLISM IN TELEOST FISHES. J. Fish Biol. 7 (6): 717-726. Nov. 1975. SFA 22(2)

[Dep. Biol., Marquette Univ., Milwaukee, WI 53233] Previous investigations have shown that mammalian prolactin has a pronounced effect on lipid deposition in teleost fishes. Prolactin can be either lipogenic or lipolytic depending on when during the day it is injected. Studies were initiated to determine whether the diurnal effects of prolactin on lipid metabolism in /Fundulus similis/ vary with season or photoperiod acclimation. Data presented here indicate that the diurnal rhythm of response to prolactin persists in the pre-spawning and post-spawning seasons if /F. similis/ is maintained on a long photoperiod. When animals are acclimated to a short photoperiod, treatment with mammalian prolactin either early or late in the photoperiod causes lipid depletion. Homogenates of the portion of the pituitary containing only prolactin cells cause lipid depletion in /F. similis/ when injected early during a long photoperiod, but stimulate lipogenesis if injected late in the photoperiod; these results imply that fish prolactin may be involved in lipid metabolism. Furthermore, prolactin activity in the pituitary of /F. similis/ varies diurnally. /In vitro/ studies of lipid metabolism in /Notemigonous crysoleucas/ and /Ictalurus natalis/ suggest that the liver may be one of the target organs for prolactin.

76-000459 Dobbs, G. H. III; DeVries, A. L. RENAL FUNCTION IN ANTARCTIC TELEOST FISHES: SERUM AND URINE COMPOSITION. Mar. Biol. 29 (1): 59-70. 21 Feb. 1975. SFA 22(2)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla]

76-000460 Epple, A.; Lewis, T. L. THE EFFECT OF PANCREATECTOMY ON THE SURVIVAL OF /ANGUILLA ROSTRATA/ IN DIFFERENT SALINITIES. J. Exp. Zool. 193 (3): 457-462. Sept. 1975. SFA 22(2)
[Jefferson Med. Coll., Thomas Jefferson Univ., Philadelphia, PA 19107] Pancreatectomized yellow eel survive well in fresh water, but very poorly in sea water. The possibility is discussed that these observations reflect a direct effect of islet hormones on the osmoregulation.

76-000461 Feldmeth, C. R.; Baskin, J. N. THERMAL AND REPIRATORY STUDIES WITH REFERENCE TO TEMPERATURE AND OXYGEN TOLERANCE FOR THE UNARMORED STICKLEBACK /GASTEROSTEUS ACULEATUS WILLIAMSONI/ HUBBS. Bull. South. Calif. Acad. Sci. 75 (2): 127-131. Aug. 1976. SFA 22(2)
[Joint Sci. Dep., Claremont Coll., Claremont, CA 91711] The tolerance to high temperature and low oxygen concentration was measured for the unarmored stickleback. These fish have a critical thermal maximum (CTM) of 30.5°C when acclimated to 8°C and a CTM of 34.6°C when acclimated to 22.7°C. Respiratory experiments indicated that the critical oxygen concentration for this species is about 2.0 ppm. Above this concentration, the respiratory rate is independent of oxygen concentration; however below 2.0 ppm, oxygen consumption rapidly declines. To maintain respiratory independence as oxygen concentration decreases, ventilatory rate rises rapidly. In an oxygen concentration of 7.4 ppm the mean ventilatory rate is 104.6 per minute. As the oxygen decreases, ventilatory rate increases to 230.7 per minute in 1.32 ppm of oxygen. In lower oxygen concentrations, gill ventilation rapidly decreases.

76-000462 Fineman, R.; Hamilton, J.; Chase, G. REPRODUCTIVE PERFORMANCE OF MALE AND FEMALE PHENOTYPES IN THREE SEX CHROMOSOMAL GENOTYPES (XX, XY, YY) IN THE KILLIFISH, /ORYZIAS LATIPES/. J. Exp. Biol. 192 (3): 349-354. June 1975. SFA 22(2)
[Dep. Human Genet., Yale Univ. Sch. Med., New Haven, CT 06510]

76-000463 Foster, R. C. RENAL HYDROMINERAL METABOLISM IN STARRY FLOUNDER, /PLATICHTHYS STELLATUS/. Comp. Biochem. Physiol. A Comp. Physiol. 55 (2): 135-140. 1976. SFA 22(2)
[Bruce Lyon Mem. Res. Lab., 51st & Grove St., Oakland, CA 94609]

76-000464 Fugelli, K.; Zachariassen, K. E. THE DISTRIBUTION OF TAURINE, GAMA-AMINOBUTYRIC ACID AND INORGANIC IONS BETWEEN PLASMA AND ERYTHROCYTES IN FLOUNDER (/PLATICHTHYS FLESUS/) AT DIFFERENT PLASMA OSMOLALITIES. Comp. Biochem. Physiol. A Comp. Physiol. 55 (2): 173-177. 1976. SFA 22(2)
[Inst. Zoophysiol., Univ. Oslo, P.O. 1051 Blindern, Oslo 3, Norway]

76-000465 Gardner, M. L. G. A REVIEW OF FACTORS WHICH MAY INFLUENCE THE SEA-AGE AND MATURATION OF ATLANTIC SALMON /SALMO SALAR/ L. J. Fish Biol. 9 (4): 289-327. Oct. 1976. SFA 22(2)
[Dep. Biochem., Univ. Edinburgh Med. Sch., Teviot Place, Edinburgh EH8 9AG, Scotland] The many enigmatic factors in the life cycle of the Atlantic salmon have long fascinated and long frustrated those working on this subject. This comprehensive review by Dr. Michael Gardner collates and summarizes the findings of investigations from the turn of the century to the present day. The author also provides an objective assessment of several hypotheses relating to the reasons for the diverse behaviour patterns of the salmon. Editor

76-000466 Gaudet, M.; Racicot, J.-G.; Leray, C. ENZYME ACTIVITIES OF PLASMA AND SELECTED TISSUES IN RAINBOW TROUT /SALMO GAIRDNERI/ RICHARDSON. J. Fish Biol. 7 (4): 505-512. July 1975. SFA 22(2)
[C. Leray: Lab. Physiol. Comp. Reg., BP 20 CR 67037, Strasbourg Cedex, France] This paper describes the determination in rainbow trout of the normal levels in the plasma of eight enzymes known to be significant in animal pathology. Some relationships between plasma enzyme levels and the enzyme activities in selected tissues are discussed. For LDH which is ubiquitously distributed, we chose, by way of saturation tests, the optimum concentrations of pyruvate and NADH in the assay medium. The LDH 'isoenzyme ratio' was determined for heart tissue, liver, and white muscle. When blood was withdrawn from caudal vessels, we observed a net increase of plasma enzyme activities, mainly of CPK and LDH, which was demonstrated to originate from surrounding muscle. Thus cardiac sampling was the only suitable way of obtaining blood for this kind of study. Slightly haemolyzed blood appeared suitable for enzyme determinations except for AlkPase which is about 50 times more concentrated in erythrocytes than in plasma. CPK was highly concentrated in the heart and the muscle, GOT was concentrated in the heart while the liver appeared to be a valuable source of GDH (as well as the kidney) and GPT.

76-000467 Griffith, R. W.; Umminger, B. L.; Grant, B. F.; Pang, P. K. T.; Goldstein, L.; Pickford, G. E. COMPOSITION OF BLADDER URINE OF THE COELACANTH, /LATIMERIA CHALUMNAE/. J. Exp. Zool. 196 (3): 371-380. June 1976. SFA 22(2)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

76-000468 Gupta, S. THE DEVELOPMENT OF CARP GONADS IN WARM WATER AQUARIA. J. Fish Biol. 7 (6): 775-782. Nov. 1975. SFA 22(2)
[28 Bremen, Rembertesing-22, West Germany] The development of carp gonads in warm water (23°C) aquaria under controlled conditions is described. In this environment males mature at 6 months of age. Females ripen at 14 months, and by 15 months 25 percent of these have started to spawn, whereas under natural conditions female European carp do not ripen until they are 4 years old. Fishes do not lay all their eggs at once, as evidenced by the finding of partly-spent ovaries. Sexual maturation of the ovaries has been described in six stages, based on histological changes, and associated with changes in the female gonado-somatic index and the maximum ova diameter. The maturation of testes occurs in four stages. The percentage incidence of each stage of ovarian maturation has been calculated for the 6th to the 15th month. Larger fishes become sexually mature before smaller fishes.

76-000469 Haywood, G. P. INDICATIONS OF SODIUM, CLORIDE, AND WATER EXCHANGE ACROSS THE GILLS OF THE STRIPED DOGFISH /PORODERMA AFRICANUM/. Mar. Biol. 29 (2): 267-276. 17 Mar. 1975. SFA 22(2)
[Dep. Zool., Univ. Cape Town, Rondebosch, Capetown, South Africa]

76-000470 Haywood, G. P. A PRELIMINARY INVESTIGATION INTO THE ROLES PLAYED BY THE RECTAL GLAND AND KIDNEYS IN THE OSMOREGULATION OF THE STRIPED DOGFISH /PORODERMA AFRICANUM/. J. Exp. Biol. 193 (2): 167-176. Aug. 1975. SFA 22(2)
[Groupe Biol. Mar., Comm. Energie Atomique, Stn. Zool. 02360 Villefrance-sur-Mer, France]

76-000471 Hazel, J. R.; Schuster, V. L. THE EFFECTS OF TEMPERATURE AND THERMAL ACCLIMATION UPON THE OSMOTIC PROPERTIES AND NONELECTROLYTE PERMEABILITY OF LIVER AND GILL MITOCHONDRIA FROM RAINBOW TROUT (/SALMO GAIRDNERI/). J. Exp. Zool. 195 (3): 425-438. Mar. 1976. SFA 22(2)
[Dep. Zool., Ariz. State Univ., Tempe 85281] Thermal acclimation of rainbow trout (/Salmo gairdneri/) taken from 20°C to 7°C resulted in adaptation of mitochondria function, as evidenced by increases in the specific activities of NADH- and succinate-cytochrome c reductase of 1.93- and 2.7-fold respectively. Mitochondria from both gill and liver obeyed the Boyle-van't Hoff relationship in the range from 400 to 60 mosM. Thermal acclimation had no effect on the osmotic properties of liver mitochondria, whereas gill mitochondria from cold-acclimated trout were more sensitive to osmotic swelling than mitochondria from warm-acclimated individuals. Regardless of the assay temperature or the permeant employed, liver mitochondria from cold-acclimated trout exhibited greater initial swelling rates than mitochondria from warm-acclimated trout, indicating properties of temperature-compensated permeability. The apparent ranking of nonelectrolyte permeabilities was urea greater than glycerol greater than mannitol greater than glucose.--From abstr.

76-000472 Holeton, G. F.; Jones, D. R. WATER FLOW DYNAMICS IN THE RESPIRATORY TRACT OF THE CARP (/CYPRINUS CARPIO/ L.). J. Exp. Biol. 63 (3): 537-549. Dec. 1975. SFA 22(2)
[Dep. Zool., Univ. Toronto, Toronto, ON, Canada]

76-000473 Hunter, J. R.; Sanchez, C. DIEL CHANGES IN SWIM BLADDER INFLATION OF THE LARVAE OF THE NORTHERN ANCHOVY, /ENGRAULIS MORDAX/. NOAA Fish. Bull. 74 (4): 847-855. Oct. 1976. SFA 22(2)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038] Laboratory and field studies demonstrated that larval anchovy 10 mm standard length and larger inflate their swim bladders each night and deflate them in the day. Maximum night levels of inflation were attained 2 h after the onset of dark and typical day levels occurred about 2 h after the onset of light. Laboratory experiments indicated that larvae fill their bladders at night by swallowing air at the water surface and the vertical distribution of sea-caught larvae suggested that they migrate to the surface each night to fill their swim bladders. Gas is released by passing bubbles through the pneumatic duct into the alimentary canal. The diel rhythm of inflation was viewed as an energy sparing mechanism. Measurements of sinking speed of larvae with and without inflated bladders suggested that the energy saved at night by inflation of the swim bladder would exceed the cost of vertical migration to the surface and that the migratory range over which energy savings are possible would be greater as larvae increased in length.

76-000474 Johnston, I. A. STUDIES ON THE SWIMMING MUSCULATURE OF THE RAINBOW TROUT. II. MUSCLE METABOLISM DURING SEVERE HYPOXIA. J. Fish Biol. 7 (4): 459-467. July 1975. SFA 22(2)
[Res. Unit Comp. Anim. Respiration, Univ. Bristol, Woodland Road, Bristol BS8 1UG, England] Some aspects of anaerobic metabolism in the red and white (mosaic) muscles of the rainbow trout have been studied during environmental hypoxia. Evidence has been obtained for the operation of anaerobic pathways other than glycolysis, especially in the superficial red muscle. L-alanine and succinate were observed to accumulate as anaerobic endproducts in this tissue. Anaerobic glycolysis also increased significantly during hypoxia, but only in the white muscle. Glycogen stores were depleted by 70-85 percent in both red and white muscle. Glucose increased in concentration in the red but not in the white muscle. In an attempt to understand some of the species differences in the susceptibility of fish to hypoxia the results of the present study have been compared with an earlier study on the carp. The effect of death from hypoxia on the levels of muscle metabolites has also been studied.

76-000475 Johnston, I. A.; Ward, P. S.; Goldspink, G. STUDIES ON THE SWIMMING MUSCULATURE OF THE RAINBOW TROUT. I. FIBRE TYPES. J. Fish Biol. 7 (4): 451-458. July 1975. SFA 22(2)
[Res. Unit Comp. Anim. Respiration, Univ. Bristol, Woodland Road, Bristol BS8 1UG, England] A histochemical study has been made on the myotomal musculature of the rainbow trout /Salmo gairdneri/ Richardson. Four main types of fibre can be distinguished on the basis of differences in fibre size, lipid content and succinic dehydrogenase and myofibrillar adenosine triphosphatase activity (ATPase activity). Early histological studies have concluded that in addition to a superficial strip of muscle small diameter 'red' fibres occur throughout the trout myotome. These small diameter fibres occurring in the bulk of the myotome are shown to differ from the superficial fibres with respect to their oxidative metabolism and myofibrillar ATPase. The relevance of this finding to studies on the energetics and swimming efficiency of this species are discussed.

76-000476 Kramer, D. L.; Graham, J. B. SYNCHRONOUS AIR BREATHING, A SOCIAL COMPONENT OF RESPIRATION IN FISHES. Copeia. 1976 (4): 689-697. 30 Dec. 1976. SFA 22(2)
[Dep. Biol., McGill Univ., Montreal, PQ, Canada]

76-000477 Lanzing, W. J. R. A TEMPORARY RESPIRATORY ORGAN IN THE TAIL OF /TILAPIA MOSSAMBICA/ FRY. Copeia. 1976 (4): 800-802. 30 Dec. 1976. SFA 22(2)
[Sch. Biol. Sci., Univ. Sydney, Sydney, N.S.W., Australia]

76-000478 Lapenas, G. N. OXYGEN PERMEABILITY OF THE TELEOST SWIMBLADDER. Ph. D. dissertation, Duke Univ. 137p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

76-000479 Larsson, A.; Johansson-Sjobeck, M.-L.; Fange, R. COMPARATIVE STUDY OF SOME HAEMATOLOGICAL AND BIOCHEMICAL BLOOD PARAMETERS IN FISHES FROM THE SKAGERRAK. J. Fish Biol. 9 (5): 425-440. Nov. 1976. SFA 22(2)

[Brackish Water Toxicol. Lab., Studsvik, Fack, S-611 01 Nykoping, Sweden] Marine fishes caught in the Skagerrak, 27 different species representing various groups of fishes (Cyclostomi, Holocephali, Elasmobranchii and Teleostei), were examined for the following haematological and biochemical blood parameters: haematocrit, haemoglobin, mean corpuscle haemoglobin concentration, total plasma protein, blood glucose and blood lactate. Interspecies variations as well as variations within some species were observed. The haemoglobin values for all species showed a positive correlation to the corresponding haematocrit values. Relatively low values for haematocrit and haemoglobin were found in cyclostomes, holocephaleans and elasmobranchii compared to the majority of teleosts. Within the teleost group, the haematocrit and haemoglobin levels were positively correlated with the activity of the fish species. The cyclostome /Myxine glutinosa/ L. had a total plasma protein content in the same range as most teleosts, whereas holocephaleans, elasmobranchii and the deep-water teleost /Coryphaenoides rupestris/ Gunnerus showed comparatively low values. Among teleosts some relationship seemed to exist between the total plasma protein level and the activity of the fish species. In addition, a correlation between plasma protein content and levels of blood lipids were noted. Values for blood glucose and blood lactate were found to be lower in cyclostomes, holocephaleans and elasmobranchii than in most teleosts. Higher blood glucose levels were observed in the more active teleost species.

76-000480 Li, M. F.; Clyburne, S. NEW CELL LINE FROM MARINE LUMPFISH, /CYCLOPTERUS LUMPUS/. J. Fish. Res. Board Can. 34 (1): 134-139. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Environ., Fish. Mar. Serv., Halifax Lab., Halifax NS B3J 2R3, Canada] A cell line was grown from fin tissue of lumpfish (/Cyclopterus lumpus/). The cells were propagated in RTO medium supplemented with NaCl at 18C and have a generation time of 108 h. They are fibroblast-like, contain numerous cytoplasmic granules, are susceptible to amphibian virus (LT-1), and have an average chromosome number of 2N = 50.

76-000481 Madden, J. A.; Houston, A. H. USE OF ELECTROANAESTHESIA WITH FRESHWATER TELEOSTS: SOME PHYSIOLOGICAL CONSEQUENCES IN THE RAINBOW TROUT, /SALMO GAIRDNERI/ RICHARDSON. J. Fish Biol. 9 (6): 457-462. Dec. 1976. SFA 22(2)

[Neurosci. Res., V.A. Hospital, Wood, WI 53193] Electroanaesthesia prompts both immediate and longer term alterations in the physiological status of the rainbow trout. These are not, by comparison with the related brook trout, more extensive than those associated with tricaine methane sulphonate (MS 222) anaesthesia. Changes in haemotological indices are minimized, while the spontaneous resumption of cardiovascular-respiratory activity, and the character of variations in plasma electrolyte levels suggest that blood gas tensions and acid-base status may be less affected by electroanaesthesia than by chemical anaesthesia. Moreover, recovery, in the control levels proceeded more rapidly in several instances. It is concluded that electroanaesthesia offers a useful alternative to chemical methods of anaesthesia.

76-000482 McHugh, J. J.; Heidinger, R. C. EFFECTS OF LIGHT ON FEEDING AND EGESTION TIME OF STRIPED BASS FRY. Prog. Fish-Cult. 39 (1): 33-34. Jan. 1977. SFA 22(2)
[Va. Comm. Game Inland Fish., 602 William St., Fredericksburg 22401] Fry of striped bass (/Morone saxatilis/) 9 to 19 days old remained active and continued to feed at night. We observed no significant difference in egestion time between fish held in light and those held in darkness. At 20°C the gastrointestinal tracts of all 15- and 19-day-old fish were emptied of marked brine shrimp in 11-12 h. None of the 9-day-old fish held at 25°C contained marked brine shrimp after 9 h.

76-000483 Murray, C. K.; Fletcher, T. C. THE IMMUNOHISTOCHEMICAL LOCALIZATION OF LYSOZYME IN PLAICE (PLEURONECTES PLATESSA/ L.) TISSUES. J. Fish Biol. 9 (4): 329-334. Oct. 1976. SFA 22(2)
[M.A.F.F. Torry Res. Stn., 135 Abbey Rd., Aberdeen AB9 8DG, Scotland] The location of lysozyme in fresh plaice (/Pleuronectes platessa/ L.) tissues was studied using an immunofluorescent technique. An antiserum to a homogeneous sample of plaice serum lysozyme was prepared in rabbits and was shown to be monospecific by immunodiffusion and inhibition studies. This preparation, used in conjunction with fluorescent labelled sheep anti-rabbit immunoglobulin, demonstrated lysozyme in plaice neutrophils, peritoneal macrophages, gill cartilage and epithelium, spleen, kidney, skin and mucus. The distribution of lysozyme in the skin and secreted mucus was affected by the method of killing the fish.

76-000484 Naiman, R. J.; Gerking, S. D.; Stuart, R. E. OSMOREGULATION IN THE DEATH VALLEY PUPFISH /CYPRINODON MILLERI/ (PISCES: CYPRINODONTIDAE). Copeia. 1976 (4): 807-810. 30 Dec. 1976. SFA 22(2)
[Dep. Zool., Ariz. State Univ., Tempe 85281]

76-000485 O'Connell, C. P. HISTOLOGICAL CRITERIA FOR DIAGNOSING THE STARVING CONDITION IN EARLY POST YOLK SAC LARVAE OF THE NORTHERN ANCHOVY, /ENGRAULIS MORDAX/ GIRARD. J. Exp. Mar. Biol. Ecol. 25 (3): 285-312. 15 Dec. 1976. SFA 22(2)
[NMFS, Southwest Fish. Cent., La Jolla, CA] The identification of fish larvae that are in starving condition in plankton samples would be a valuable aid in estimating early mortality rates of populations in the sea. Histological criteria are given for determining the degree of starvation-induced emaciation, with an indication of its relevance to mortality, for larvae of the northern anchovy, /Engraulis mordax/ Girard. Larvae were reared with and without food to age 9 days, i.e., beyond the point of yolk absorption. Eleven histological characteristcs were each graded on scales of poor, intermediate or good, depending variously on texture, shape and fullness of nuclei, cytoplasm, extracellular substance, and cellular products and storage material. Grades varied with food deprivation, so that increasing emaciation may be estimated from histological variables. Distribution of the grades also paralleled trends in survival and length, indicating that degree of emaciation reflects the probability of survival. The histological variables that best classified larvae as severely emaciated, moderately emaciated, or robust in a stepwise discriminant analysis were pancreas condition, trunk muscle fiber separation, intermuscular tissue, and liver cytoplasm. The discriminant analysis suggest that an average of grades for three or four characteristics is sufficient for determing the state of emaciation of a larva.

76-000486 Oduleye, S. O. THE EFFECTS OF HYPOPHYSECTOMY, PROLACTIN THERAPY AND ENVIRONMENTAL CALCIUM ON FRESHWATER SURVIVAL AND SALINITY TOLERANCE IN THE BROWN TROUT /SALMO TRUTTA/ L. J. Fish Biol. 9 (6): 463-470. Dec. 1976. SFA 22(2)

[Dep. Zool., Univ. Ibadan, Ibadan, Nigeria] Hypophysectomy resulted in a loss of ability of the euryhaline salmonid, /Salmo trutta/ to survive in fresh water. The mean survival time was 4-5 days. Maintenance in a medium containing 5 mM calcium increased the mean survival time to 8 days while 10 mM decreased it. Injection of 0.2 I.U./gm prolactin enabled hypophysectomized fish to survive the 2-week duration of the experiment. High environmental calcium, or pre-adaptation to a medium of high calcuim, increased salinity tolerance of the brown trout probably by promoting a quick return of plasma electrolyte concentration to normal after transfer to sea water.

76-000487 Oduleye, S. O. THE EFFECT OF HYPOPHYSECTOMY AND PROLACTIN THERAPY ON WATER BALANCE OF THE BROWN TROUT /SALMO TRUTTA/. J. Exp. Biol. 63 (2): 357-366. Oct. 1975. SFA 22(2)

[Dep. Zool., Univ. Ibadan, Ibadan, Nigeria] A technique for the hypophysectomy of the brown trout is described which might be applicable to other salmonids. Hypophysectomy produced a decrease in water turnover which was corrected by prolactin therapy. Hypophysectomy resulted in a decrease in the net flux of osmotic water. Both osmotic and diffusional water permeabilities were evenly decreased after hypophysectomy, such that the ratio of the osmotic and diffusional permeability coefficients (P(os)/P(d)) retained a value of approximately unity. The data suggest that calcium and prolactin have opposing actions on water balance and that their modes of action are likely to be separate.--Summ.

76-000488 Oduleye, S. O. THE EFFECTS OF CALCIUM ON WATER BALANCE OF THE BROWN TROUT /SALMO TRUTTA/. J. Exp. Biol. 63 (2): 343-356. Oct. 1975. SFA 22(2)

[Dep. Zool., Univ. Ibadan, Ibadan, Nigeria] Water space, tritiated water flux, drinking and urine flow rates of the brown trout were decreased by increasing the environmental calcium concentration. Diffusional and osmotic permeabilities were identical in fresh water. This suggests that water flow across the gill occurs entirely by diffusion. Previous suggestions of a discrepancy between the two permeabilities in freshwater teleosts could have been due to an overestimation of urine flow rate upon which the determination of osmotic permeability coefficient is based. The wide-ranging effects of calcium on hydro-mineral regulation suggests that the ion interacts with the gills.--Summ.

76-000489 Pandian, T. J.; Vivekanandan, E. EFFECTS OF FEEDING AND STARVATION ON GROWTH AND SWIMMING ACTIVITY IN AN OBLIGATORY AIR-BREATHING FISH. Hydrobiologia 49 (1): 33-39. Apr. 1976. SFA 22(2)

[Zool. Dep., Madurai Univ. P.G. Cent., Palni, Tamilnadu, India]

76-000490 Pang, P. K. T.; Sawyer, W. H. PARATHYROID HORMONE PREPARATIONS, SALMON CALCITONIN, AND URINE FLOW IN THE SOUTH AMERICAN LUNGFISH, /LEPIDOSIREN PARADOXA/. J. Exp. Biol. 193 (3): 407-412. Sept. 1975. SFA 22(2)
[Dep. Biol., Brooklyn Coll. C.U.N.Y., Brooklyn, NY]

76-000491 Perez, J. E.; Maclean, N. THE HAEMOGLOBINS OF THE FISH /SAROTHERODON MOSSAMBICUS/ (PETERS): FUNCTIONAL SIGNIFICANCE AND ONTOGENETIC CHANGES. J. Fish Biol. 9 (5): 447-455. Nov. 1976. SFA 22(2)
[Dep. Biol., Univ. Oriente, Cumana, Venezuela] The haemoglobin patterns of adult and young larval stages of the fish species /Sarotherodon mossambicus/ were determined by polyacrylamide-gell electrophoresis. Oxygen affinity determinations of the adult and larval haemolysates and of each haemoglobin component of the adult indicates that the affinity changes with the pH, temperature and osmotic pressure. The possible evolutionary significance of the multiple haemoglobins is discussed. The electrophoretic pattern of adult /S. leucostictus/, a species closely related to /S. mossambicus/ was also determined and used as a comparative study.

76-000492 Perrier, H.; Perrier, C.; Delcroix, J. P.; Bornet, H.; Gras, J. STUDY OF THE IODIDE BINDING PROTEIN OF THE PLASMA OF THE RAINBOW TROUT (/SALMO GAIRDNERII/ RICHARDSON). Comp. Biochem. Physiol. A Comp. Physiol. 55 (2): 165-167. 1976. SFA 22(2)
[Univ. Claude Bernard, 8 Rockefeller Ave., 69373 Lyon Cedex 2, France]

76-000493 Peterson, R. H.; Spinney, H. C. E.; Sreedharan, A. DEVELOPMENT OF ATLANTIC SALMON (/SALMO SALAR/) EGGS AND ALEVINS UNDER VARIED TEMPERATURE REGIMES. J. Fish. Res. Board Can. 34 (1): 31-43. Jan. 1977. In English with French summ. SFA 22(2)
[Dep. Environ., Fish Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Atlantic salmon (/Salmo salar/) eggs and alevins were raised under conditions where the temperature was systematically varied either at fertilization, at the eyed egg stage, or at hatching. Mortality was more than 20 percent in eggs started immediately after fertilization at constant incubation temperatures less than 4C as compared with 5 percent or less at temperatures greater than 4C. Alevins that eyed at 8C and higher were progressively smaller the higher the temperature. The optimum temperature from fertilization to eye pigmentation was near 6C. Eyed eggs reared at lower temperatures until hatching were larger than those hatched at higher temperatures. This size differential was maintained until the yolk was completely absorbed at all posthatching temperatures investigated. Sudden decreases in temperature at the eyed egg and hatching stages induced severe edema of the alevin yolk sac, resulting in slower growth and increased mortality.

76-000494 Priede, I. G. THE BLOOD CIRCULATORY FUNCTION OF THE DORSAL AORTA LIGAMENT IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Zool. (Lond.) 175 (1): 39-52. Jan. 1975. SFA 22(2)
[Dep. Biol., Univ. Stirling, Scotland] An elastic longitudinal ligament stretched under considerable tension lies within the dorsal aorta of Rainbow trout. Experiments with mechanically simulated swimming movements in an artificial model demonstrate that such a ligament can act as a pump mechanism. The output of the pump increases with tail beat frequency up to a certain point where the mechanism tends to break down. Investigations on the trout dorsal aorta show

76-000494 CONTINUED
that pump breakdown probably takes place at relatively low output pressures. Fundamental blood flow considerations indicate that a fully effective dorsal aorta pump over the full range of swimming speeds in undesirable. It is concluded that the dorsal aorta ligament can act as a pump which automatically increases circulation during swimming particularly to the body musculature. The output pressure is small but may be of significance in causing reflex increase in cardiac output.

76-000495 Rao, T. R. SALINITY TOLERANCE OF LABORATORY-REARED LARVAE OF THE CALIFORNIA KILLIFISH, /FUNDULUS PARVIPINNIS/ GIRARD. J. Fish Biol. 7 (6): 783-790. Nov. 1975. SFA 22(2)
[Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe 96744] Newly hatched larvae of the California killifish (/Fundulus parvipinnis/) reared in the laboratory, were tolerant of salinities from fresh water to 70°/oo. Their salinity tolerance was influenced by incubation salinity; larvae hatched in lower incubation salinities exhibited greater freshwater tolerance than those hatched in higher salinities. In gradual acclimation tests, the upper median lethal salinity for the larvae was 130°/oo. Freshwater tolerance of the larvae decreased with age; yolk sac larvae were completely tolerant of fresh water while larvae more than 15 days old were least resistant.

76-000496 Raymond, J. A.; Lin, Y.; DeVries A. L. GLYCOPROTEIN AND PROTEIN ANTIFREEZES IN TWO ALASKAN FISHES. J. Exp. Biol. 193 (1): 125-130. July 1975. SFA 22(2)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92037] Two macromolecular freezing point depressants have been isolated from the serums of two species of Alaskan fishes. A common property of the four antifreezes thus far isolated is a high alanine content which suggests that the mechanism of these antifreezes may be related to a repeating tripeptide unit.

76-000497 Raymond, J. A.; DeVries, A. L. SOME RESPIRATORY CHARACTERISTICS OF THE BLOOD OF FOUR ANTARCTIC FISHES. J. Exp. Zool. 196 (3): 393-396. June 1976. SFA 22(2)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093] Oxygen equilibrium curves of blood from four antarctic fishes were obtained at subzero temperatures. Oxygen contents were measured directly and the results on two of these fishes agreed favorably with previous studies in which oxygen electrodes were used.

76-000498 Sailendri, K.; Muthukkaruppan, Vr. THE IMMUNE RESPONSE OF THE TELEOST, /TILAPIA MOSSAMBICA/ TO SOLUBLE AND CELLULAR ANTIGENS. J. Exp. Zool. 191 (3): 371-382. Mar. 1975. SFA 22(2)
[Vr. Muthukkaruppan: dep. Biol. Sci., Madurai Univ., Madurai-625021, India]

76-000499 Saksena, V. P. EFFECTS OF TEMPERATURE AND LIGHT ON AERIAL BREATHING OF THE LONGNOSE GAR, /LEPISOSTEUS OSSEUS/. Ohio J. Sci. 75 (1): 58-62. Jan. 1975. SFA 22(2)
[Dep. Biol., Muskingum Coll., New Concord, OH 43762]

76-000500 Saksena, V. P. EFFECTS OF TEMPERATURE AND LIGHT ON AERIAL BREATHING OF THE SHORTNOSE GAR, /LEPISOSTEUS PLATOSTOMUS/. Ohio J. Sci. 75 (4): 178-181. July 1975. SFA 22(2)
[Dep. Biol., Muskingum Coll., New Concord, OH 43762]

76-000501 Scott, D. B. C. A HERMAPHRODITE SPECIMEN OF /COREGONUS LAVARETUS/ (L.) (SALMONIFORMES, SALMONIDAE) FROM LOCH LOMOND, SCOTLAND. J. Fish Biol. 7 (5): 709. Sept. 1975. SFA 22(2)
[Zool. Dep., Univ. St. Andrews, Scotland] A single hermaphrodite specimen of /Coregonus lavaretus/ (L.) was caught mid-January in Loch Lomond, Scotland.

76-000502 Siret, J. R.; Carmena, A. O.; Callejas, J. ERYTHROKINETIC STUDY IN THE FISH MANJUARI (ATRACTOSTEUS TRISTOECHUS/). Comp. Biochem. Physiol A Comp. Physiol. 55 (2): 127-128. 1976. SFA 22(2)
[Dep. Fisiol., Inst. Hematol. Immunol., Havana, Cuba]

76-000503 Smith, A. C.; Ramos, F. OCCULT HAEMOGLOBIN IN FISH SKIN MUCUS AS AN INDICATOR OF EARLY STRESS. J. Fish Biol. 9 (6): 537-541. Dec. 1976. SFA 22(2)
[Dep. Pathol., John A. Burns Sch. Med., Univ. Hawaii, 1960 East-West Rd., Honolulu] Early induced stress may result in the release of free haemoglobin into the skin mucus of teleostean fishes. If this were the case, it could be indicated quickly and simply by the colour change of a commercially available haemoglobin test strip. Preliminary tests on /Mugil cephalus/ (grey mullet) encouraged more extensive investigations with /Chanos chanos/ (milkfish), /Caranx ignobilis/ (papio), /Albula vulpes/ (bonefish), and /Chaetodon miliaris/ (butterfly fish). The results indicated that unstressed individuals of these species have no detectable haemoglobin in their skin mucus but, within 2-4 min, the pigment will appear in occult amounts if stress is applied. Additional studies confirmed that it was haemoglobin and no other possible contaminants in the mucus which caused the colour change of the test strip. The technique is simple and quick, and is itself harmless to the fish. It is of immediate potential value to fish culturists for the detection of early stress conditions. Efforts can then be made to lessen or remove the stress conditions before debility and possibly overt disease take over. A further application of the technique may be the identification of individuals genetically better able to resist disease.

76-000504 Soivio, A.; Nynolm, K.; Westman, K. A TECHNIQUE FOR REPEATED SAMPLING OF THE BLOOD OF INDIVIDUAL RESTING FISH. J. Exp. Biol. 63 (1): 207-217. Aug. 1975. SFA 22(2)
[Div. Physiol. Zool., Dep. Zool., Univ. Helsinki, Arkadiankatu 7, 00100 Helsinki 10, Finland] A dorsal cannulation technique is described. It has been employed for repeated blood sampling in unanaesthetized rainbow trout (/Salmo gairdneri/) kept singly in special receptacles described in the paper. The level of the studied haematological parameters differed between fish kept in receptacles for 1 week and free-swimming fish, most probably owing to differences in the motility of the fish. The receptacle seems to minimize visual and handling disturbances, and permits both the standardization of experimental conditions and quick and easy sampling via the dorsal aorta cannula. The general variation in the blood parameter values was very small compared with the previously reported variation in such values for rainbow trout.--From summ.

76-000505 Sylvester, J. R.; Nash, C. E.; Emberson, C. R. SALINITY AND OXYGEN TOLERANCES OF EGGS AND LARVAE OF HAWAIIAN STRIPED MULLET, /MUGIL CEPHALUS/ L. J. Fish Biol. 7 (5): 621-629. Sept. 1975. SFA 22(2)

[Oceanic Inst., Waimanalo, HI 96795] Salinity and oxygen tolerances of eggs and larvae of Hawaiian striped mullet (/Mugil cephalus/ L.) were studied. Optimal salinities for eggs incubated at 19.5-20.5° C were 30-32°/oo. Maximum larval survival occurred within the salinity range of 26-28°/oo. Significant decreases in egg survival occurred with eggs incubated in mean oxygen concentrations below 5.0 p.p.m. and for larvae held in mean oxygen concentrations below 5.4 p.p.m. The results are discussed in terms of spawning sites and the effects of oxygen saturation values on fish eggs and larvae.

76-000506 Tang, F.; Chan, S. T. H.; Lofts, B. A STUDY OF THE 3BETA- AND 17BETA-HYDROXYSTEROID DEHYDROGENASE ACTIVITIES IN THE GONADS OF /MONOPTERUS ALBUS/ (PISCES: TELEOSTEI) AT VARIOUS SEXUAL PHASES DURING NATURAL SEX REVERSAL. J. Zool. (Lond.) 175 (4): 571-580. Apr. 1975. SFA 22(2)

[Dep. Zool., Univ. Hull, England]

76-000507 Webb, P. W. ACCELERATION PERFORMANCE OF RAINBOW TROUT /SALMO GAIRDNERI/ AND GREEN SUNFISH /LEPOMIS CYANELLUS/. J. Exp. Biol. 63 (2): 451-465. Oct. 1975. SFA 22(2)

[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48104]

76-000508 Weintraub, M. J. THE INFLUENCE OF ACTIVITY LEVEL ON BRADYCARDIA IN TROUT (/SALMO GAIRDNERI/) DURING HYPOXIA. J. Fish Biol. 7 (6): 791-796. Nov. 1975. SFA 22(2)

[Dep. Med., Beth Israel Hospital, 330 Brookline Ave., Boston, MA 02215] Voltages associated with heartbeat were transmitted by radio from free-swimming rainbow trout (/Salmo gairdneri/). Variability in the bradycardia response associated with the hypoxic state was observed and appeared to be related to the normal activity state of the fish. Bradycardia as a physiological mechanism was discussed on the basis of this finding.

76-000509 Whitfield, A. K.; Blaber, S. J. M. THE EFFECTS OF TEMPERATURE AND SALINITY ON /TILAPIA RENDALLI/ BOULENGER 1896. J. Fish Biol. 9 (2): 99-104. Aug. 1976. SFA 22(2)

[Zool. Dep., Univ. Natal, Pietermaritzburg, South Africa] Temperature and salinity tolerances of /Tilapia rendalli/ were determined experimentally. Results indicate that they are tolerant over a wide range of temperatures (11-37° C), but are incapable of surviving in salinities above 19°/oo. The maximum salinity tolerance is at temperatures between 20-28° C. The osmostic concentration of the blood rises from 255 mosmol/l in freshwater to 340 mosmol/l in a salinity of 19°/oo. /T. rendalli/ is restricted to the warmer waters of the Zambezi river system in central Africa and southwards to the Pongolo river, as well as certain tropical and subtropical brackish water lagoons and lakes. Evidence from these experiments suggest that the distribution of /T. rendalli/ is governed by both temperature and salinity.

76-000510 Williams, G. C. VIABLE EMBRYOGENESIS OF THE WINTER FLOUNDER /PSEUDOPLEURONECTES AMERICANUS/ FROM -1.8 TO 15 C. Mar. Biol. 33 (1): 71-74. 10 Nov. 1975. SFA 22(2)
[Dep. Ecol. Evol., State Univ. N.Y., Stony Brook]
/Pseudopleuronectes americanus/ spawns in late winter near New York, and its eggs may be found in shallow water under ice at temperatures below the usual freezing point of vertebrate tissues. Survival and duration of development at a variety of constant temperatures were recorded for artificially fertilized eggs in the laboratory. Many eggs hatched into normal larvae after 2 months at the lowest temperature tried, -1.8°C. The upper lethal temperature was about 15°C. There was a linear relation between log time and temperature in the minimum mortality range (0° to 10°C), with a Q(10) of about 4.8.

76-000511 Wood, C. M.; Shelton, G. PHYSICAL AND ADRENERGIC FACTORS AFFECTING SYSTEMIC VASCULAR RESISTANCE IN THE RAINBOW TROUT: A COMPARISON WITH BRANCHIAL VASCULAR RESISTANCE. J. Exp. Biol. 63 (2): 505-523. Oct. 1975. SFA 22(2)
[Dep. Biol., Univ. Calgary, Calgary AB T2N 1N4, Canada]

76-000512 Yamagami, K. RELATIONSHIP BETWEEN TWO KINDS OF HATCHING ENZYMES IN THE HATCHING LIQUID OF THE MEDAKA, /ORYZIAS LATIPES/. J. Exp. Zool. 192 (1): 127-132. Apr. 1975. SFA 22(2)
[Zool. Inst., Fac. Sci., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

76-000513 Zeitoun, I. H.; Ullrey, D. E.; Bergen, W. G.; Magee, W. T. DNA, RNA, PROTEIN, AND FREE AMINO ACIDS DURING ONTOGENESIS OF RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 34 (1): 83-88. Jan. 1977. In English with French summ. SFA 22(2)
[Dep. Anim. Husb., Mich. State Univ., East Lansing 48824] During the first 2 wk of incubation, the pattern of change in DNA concentration tended to precede similar changes in RNA concentration. Unfertilized eggs contained 23.2 and 77.2 ug of DNA and RNA, respectively. DNA concentration rose from 155.8 ug/fry (after 23 days of incubation) to 326.6 ug/larva (14 days after hatching), while RNA increased from 238.8 to 693.3 ug during the same period. Protein per ontogenetic unit was relatively constant during the prehatching stages but dropped markedly just prior to hatching. Of the protein in the unfertilized egg, approximately 20 percent was retained in the fry at hatching and approximately 50 percent was retained in the larva following yolk absorption. Total free amino acid concentrations declined just after fertilization, indicating the initiation of protein synthesis or a decline in yolk protein degradation. These concentrations increased to near initial values in the blastula and were nearly doubled in the yolk plus fry at hatching.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

76-000514 Blaxhall, P. C. FISH CHROMOSOME TECHNIQUES--A REVIEW OF SELECTED LITERATURE. J. Fish Biol. 7 (3): 315-320. May 1975. SFA 22(2)
[Dep. Life Sci., Trent Polytech., Nottingham, NG1 1BU, England]
This is a review of some of the literature on the use of chromosome techniques with fish. There is a need for developing methods which leave the animal alive. Such a test is the leukocyte culture method used in human medicine. Once a reliable test has been developed the results should show more consistent karyotypes and better morphology

76-000514 CONTINUED
thus providing information of use in cytotaxonomy, fish-breeding and in studying the effects of sub-lethal levels of water pollutants on fish.

76-000515 Brassington, R. A.; Ferguson, A. ELECTROPHORETIC IDENTIFICATION OF ROACH (/RUTILUS RUTILUS/ L.), RUDD (/SCARDINIUS ERYTHROPHTHALMUS/ L.), BREAM (/ABRAMIS BRAMA/ L.) AND THEIR NATURAL HYBRIDS. J. Fish Biol. 9 (6): 471-477. Dec. 1976. SFA 22(2)
[Fish. Dep., Gwynedd River Div., Highfield, Caernarvon, Gwynedd LL55 1HR, England] Roach, rudd, bream and their natural hybrids of 2 cm standard length or larger can be definitively identified by their enzyme electrophoretic patterns. Zymograms of lactate dehydrogenase and esterases as produced by vertical starch gel electrophoretic analysis of whole fry or adult eye extracts are the most useful in this respect. The lactate dehydrogenase isozymes, containing B subunits, migrate more anodally in rudd and bream than in roach. Due to the tetrameric structure of lactate dehydrogenase, in hybrid rudd x roach and roach x bream, eleven isozymes can be observed as compared with six in the parental patterns. Esterases show unique patterns for all species and hybrids. With the exception of one fraction in rudd x bream, the esterase patterns of hybrids show summations of the parental phenotypes.

76-000516 Champion, M. J.; Whitt, G. S. DIFFERENTIAL GENE EXPRESSION IN MULTILOCUS ISOZYME SYSTEMS OF THE DEVELOPING GREEN SUNFISH. J. Exp. Zool. 196 (3): 263-282. June 1976. SFA 22(2)
[G. S. Whitt: Dep. Genet. Develop., 515 Morrill Hall, Univ. Ill., Urbana 61801]

76-000517 De Cristini, F.; Graziosi, G. ELECTROPHORETIC ANALYSES AND DENATURATION TESTS OF THE HAEMOGLOBINS OF /TRACHURUS TRACHURUS/ (L.). J. Fish Biol. 9 (5): 401-403. Nov. 1976. SFA 22(2)
[Inst. Zool. Anat. Comp., Univ. Trieste, Trieste, Italy] A total of 210 samples of haemoglobin of /Trachurus trachurus/ (L.) caught in the Gulf of Trieste in 1972-1973, were analysed in search of haemoglobin polymorphism. Genetic polymorphism may be used as a genetic marker to identify sub-populations on the basis of allele frequencies. All the samples analysed produced the same haemoglobinic pattern, composed of six bands. The quantitative differences noted between the various fractions were not sufficient to demonstrate the existence of different phenotypes. Denaturation tests carried out by treating erythrocytes with non-sterile physiological solutions or by keeping the haemolysate at room temperature before electrophoresis, resulted in new patterns. This result shows the importance of the careful treatment of blood samples to assure reliable results.

76-000518 Fitzsimons, J. M. ETHOLOGICAL ISOLATING MECHANISMS IN GOODEID FISHES OF THE GENUS /XENOTOCA/ (CYPRINODONTIFORMES, OSTEICHTHYES). Bull. South. Calif. Acad. Sci. 75 (2): 84-99. Aug. 1976. SFA 22(2)
[Mus. Zool., La. State Univ., Baton Rouge 70803] Although no natural hybrids are known, fertile laboratory hybrids were readily obtained from /Xenotoca eiseni/ and /X. melanosoma/ in forced crosses in which a conspecific mate was not available. In choice crosses with males and females of both species, sympatric stocks never hybridized, but allopatric fishes frequently mismated. Ethological data reveal differences in courtship behavior and discriminatory ability in sympatric fishes not observed for allopatric conspecific stocks nor in fish from two populations of the congener /X. variata/. These

76-000518 CONTINUED
differences, which prevent interbreeding, are offered as evidence for the perfection of premating isolating mechanisms in sympatry. Hybrid inferiority, essential for divergence in sympatry, was reflected in reduced survival and inability to compete for mates.

76-000519 Grossman, G. D. POLYMORPHISM OF PLASMA ESTERASES IN RAINBOW TROUT. Prog. fish-Cult. 39 (1): 35-36. Jan. 1977. SFA 22(2)
[Div. Wildl. Fish. Biol., Univ. Calif., Davis 95616] Horizontal starch-gel electrophoresis was conducted on the nonspecific plasma esterases of two populations of rainbow trout (/Salmo gairdneri/). The enzymes were found to be polymorphic and a possible system of genetic control was postulated.

76-000520 Iuchi, I.; Suzuki, R.; Yamagami, K. ONTOGENETIC EXPRESSION OF LARVAL AND ADULT HEMOGLOBIN PHENOTYPES IN THE INTERGENERIC SALMONID HYBRIDS. J. Exp. Zool. 192 (1): 57-64. Apr. 1975. SFA 22(2)
[Zool. Inst., Fac. Sci., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

76-000521 Kynard, B.; Curry, B. MERISTIC VARIATION IN THE THREE-SPINE STICKLEBACK, /GASTEROSTEUS ACULEATUS/, FROM AUKE LAKE, ALASKA. Copeia. 1976 (4): 811-813. 30 Dec. 1976. SFA 22(2)
[Ariz. Coop. Fish. Res. Unit, Univ. Ariz., Tucson 85721]

76-000522 Page, L. M. NATURAL DARTER HYBRIDS: /ETHEOSTOMA GRACILE/ X /PERCINA MACULATA/, /PERCINA CAPRODES/ X /PERCINA MACULATA/, AND /PERCINA PHOXOCEPHALA/ X /PERCINA MACULATA/. Southwest. Nat. 21 (2): 161-168. 25 June 1976. SFA 22(2)
[Ill. Nat. Hist. Surv., Urbana 61801]

76-000523 Stanley, J. G.; Jones, J. B. MORPHOLOGY OF ANDROGENETIC AND GYNOGENETIC GRASS CARP, /CTENOPHARYNGODON IDELLA/ (VALENCIENNES). J. Fish Biol. 9 (6): 523-528. Dec. 1976. SFA 22(2)
[Maine Coop. Fish. Res. Unit, Univ. Me., Orono 04473] Crosses between female carp x male grass carp resulted in androgenetic grass carp and hybrids. Fertilizing grass carp eggs with carp milt that had been irradiated with ultraviolet light for 15 min at 1.0 mW/cm² produced gynogenetic grass carp. We compared the morphology of experimental progeny with that of the parental species to determine if inheritance was strictly matroclinous in gynogenesis and strictly patroclinous in androgenesis. Dorsal and anal fin rays, lateral line scales, gill rakers, pharyngeal teeth, and the relative length of the dorsal fin all suggested that gynogenetic grass carp were identical with the maternal species and androgenetic grass carp with the paternal species. Hybrids were intermediate between the parents except that the number of anal rays was identical with that in carp. The number of dorsal rays, the body depth, and the pharyngeal teeth in hybrids were more like those in carp than in grass carp, whereas the number of gill rakers was more similar to that in the paternal species.

76-000524 Strommen, C. A.; Rasch, E. M.; Balsano, J. S. CYTOGENETIC STUDIES OF /POECILIA/ (PISCES) V. CYTOPHOTOMETRIC EVIDENCE FOR THE PRODUCTION OF FERTILE OFFSPRING BY TRIPLOIDS RELATED TO /POECILIA FORMOSA/. J. Fish Biol. 7 (5): 667-676. Sept. 1975. SFA 22(2)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233] To monitor the perpetuation of triploid genomes in laboratory-reared progeny of wild-caught females of /Poecilia/, amounts of DNA-Feulgen staining in scale epithelial nuclei were determined for 58 different fish. Based on estimates of average DNA content, these specimens were readily separated into two groups: (a) diploids, with an average of 1.57 x 10^{-12} g DNA per cell and (b) triploids, with an average of 2.38 x 10^{-12} g DNA per cell. These values yield a ratio of 1:1.5, as would be expected from the presence of an extra chromosome set in putative triploid females. Ploidy status of the latter, based on DNA cytophotometry, was independently confirmed for several specimens by direct cytological examination of chromosome number, by electrophoresis of plasma proteins and by morphometric analysis. These findings unequivocally document one case involving the production of triploid offspring from a typical, diploid /P. formosa/ and several instances in which broods of all-female triploid offspring were derived in the laboratory from both wild-caught and laboratory-reared triploid mothers. The relationship and significance of these triploid forms to the breeding complex of /P. formosa/ and /P. mexicana/ in nature are discussed.

76-000525 Wheeler, A. ON THE POPULATIONS OF ROACH (/RUTILUS RUTILUS/), RUDD (/SCARDINIUS ERYTHROPHTHALMUS/), AND THEIR HYBRID IN ESTHWAITE WATER, WITH NOTES ON THE DISTINCTIONS BETWEEN THEM. J. Fish Biol. 9 (5): 391-400. Nov. 1976. SFA 22(2)
[Dep. Zool., British Mus. (Nat. Hist.), London SW7 5BD, England] Samples of cyprinid fishes from Esthwaite Water, Westmorland, have been examined and identified as roach (/Rutilus rutilus/), rudd (/Scardinius erythrophthalmus/), with a high degree (37 percent) of hybridization between these species. The distinguishing features of roach and rudd are discussed in the light of the difficulty of distinguishing the roach x rudd hybrid from the roach. It is concluded that the only reliable characters are the nulmber and external morphology of the pharyngeal teeth.

BEHAVIOR

76-000526 Alevizon, W. S. MIXED SCHOOLING AND ITS POSSIBLE SIGNIFICANCE IN A TROPICAL WESTERN ATLANTIC PARROTFISH AND SURGEONFISH. Copeia. 1976 (4): 796-798. 30 Dec. 1976. SFA 22(2)
[Dep. Biol. Sci., Fla. Inst. Technol., Melbourne 32901]

76-000527 Atkinson, R. J. A. SOME PRELIMINARY FIELD OBSERVATIONS OF THE BURROWS OF THE RED BAND FISH, /CEPOLA RUBESCENS/ L. J. Fish Biol. 9 (2): 181-183. Aug. 1976. SFA 22(2)
[Univ. Mar. Biol. Stn., Millport, Isle of Cumbrae, Scotland] The burrows of the red band fish, /Cepola rubescens/ L. were studied. They were located in sublittoral mud some 17 m below C.D. off the coast of Lundy Island. The burrows were vertical to a depth of 60 cm, the same length as the fish, and had a diameter of 6-8 cm.

76-000528 Barlow, G. W. ON THE SOCIOBIOLOGY OF FOUR PUERTO RICAN PARROTFISHES (SCARIDAE). Mar. Biol. 33 (4): 281-293. Dec. 1975. SFA 22(2)

[Dep. Zool., Mus. Vert. Zool., Univ. Calif., Berkeley] Behavioral observations were made during SCUBA excursions out of the PRINUL underwater laboratory, off the west coast of Puerto Rico. Most of the work involved four species of parrotfishes, /Sparisoma viride/, /Sparisoma aurofrenatum/, /Scarus croicensis/ and /Scarus taeniopterus/. The species of /Sparisoma/ are relatively patrilocal, solitary, slowly and steadily feeding fishes; the terminal phase (termphase) males of /S. aurofrenatum/ hold large territories that encompass the home ranges, possibly territories, of a number of females. The two species of /Scarus/ are roving, aggregating fish that periodically descend to the bottom where they feed rapidly. Reproductive males are of two types, either highly dimorphic, brilliantly colored termphase males, or midphase males that resemble the females. At times, termphase males become territorial and are visited by females and midphase males. Females spawn with termphase and with midphase males. Aggression in all four species was directed largely to conspecific individuals. All species show the ability to change color rapidly, sometimes dramatically, in social interactions.

76-000529 Brewer, G. D. THE BIOLOGY OF THE NORTHERN ANCHOVY (/ENGRAULIS MORDAX/) IN RELATION TO TEMPERATURE. Ph. D. dissertation, Univ. South. Calif. 1975. From Diss. Abstr. Int. B Sci. Eng. 36(11), 1976. SFA 22(2)

Juvenile and adult fish, acclimated to six constant temperatures between 8 and 28C, were found to have upper lethal (96-hour LD(50)) temperatures between 23.7 and 29.4C; lower lethal temperatures were between 6.8 and 12.4C. Maximum tolerance limits of juveniles and adults were estimated to be 6.5 and 29.5C. Acclimation, as measured by resistance, from 12 to 20C was nearly complete after two days exposure to the higher temperature; acclimation from 20 to 12C was nearly complete after six days exposure to the lower temperature. Fish subjected to fluctuating water temperatures between 12 and 20C on a 48-hour cycle proved less resistant to cold than a 12C (constant) acclimated group and less risistant to heat than a 20C (constant) acclimated group. Larvae in the yolk-sac stage were found to have upper lethal (24-hour LD(50)) temperatures between 29.4 and 30.7C and lower lethal temperatures between 8.2 and 10.1C when acclimated to four constant temperatures between 12 and 24C. Maximum tolerance limits of larvae in the yolk-sac stage were estimated to be 7.0 and 30.2C. Field and laboratory data suggest that almost all spawning occurs when surface water temperatures are between 13 and 18C, and that photoperiod is not a dominant factor in controlling the anchovies' reproductive cycle. Temperature, in relation to anchovy distribution and survival under natural and artificially created thermal conditions, is discussed.--From abstr.

76-000530 Colesante, R. T. BEHAVIOR OF MUSKELLUNGE FRY DURING YOLK ABSORPTION AND SWIM-UP. N.Y. Fish Game J. 24 (1): 94. Jan. 1977. SFA 22(2)

[N.Y. State Dep. Environ. Conserv., Albany 12201]

76-000531 Datsun, R. C. MINIMUM SWIMMING SPEED OF ALBACORE, /THUNNUS ALALUNGA/. NOAA Fish. Bull. 74 (4): 955-960. Oct. 1976. SFA 22(2)

[NMFS, Southwest Fish. Cent., La Jolla, CA 92038] Measurements of density and pectoral lifting area of albacore, /Thunnus alalunga/, were made and compared with those previously described for yellowfin tuna, /Thunnus albacares/; bigeye tuna, /Thunnus obesus/; and skipjack tuna, /Katsuwonus pelamis/. Albacore have densities within the range of yellowfin tuna of similar size. The pectoral lifting area of albacore was always greater than skipjack tuna but similar to yellowfin tuna and bigeye tuna for fish less than 70 cm long. Larger albacore had increasingly larger fins than did the other species. Minimum speed necessary for hydrostatic equilibrium of albacore was calculated and compared at 50 and 80 cm fork lengths to values calculated for the species above. Albacore minimum speeds were slower than those for skipjack tuna, similar to those of yellowfin tuna, and greater than those of bigeye tuna. Density variations of albacore, attributed to fat content and gas bladder volume, significantly affected estimates of minimum speed. Calculated speeds were slower than those estimated for albacore tracked at sea or estimated from tag returns.

76-000532 DuBois, A. B.; Cavagna, G. A.; Fox, R. S. LOCOMOTION OF BLUEFISH. J. Exp. Zool. 195 (2): 223-236. Feb. 1976. SFA 22(2)

[Dep. Physiol., Univ. Pa. Sch. Med., Philadelphia 19174]

76-000533 Feng, A. S. THE EFFECT OF TEMPERATURE ON A SOCIAL BEHAVIOR OF WEAKLY ELECTRIC FISH /EIGENMANNIA VIRESCENS/. Comp. Biochem. Physiol. A Comp. Physiol. 55 (2): 99-102. 1976. SFA 22(2)

[Scripps Inst. Oceanogr., La Jolla, CA 92093] The frequency of the electric organ discharge (EOD) of /Eigenmannia virescens/ changes with water temperature and with the presence of an electrical sine wave stimulus of a neighboring frequency. The latter response, called the jamming avoidance response, was observed at various temperatures ranging from 18 to 30°C. Jamming avoidance response (JAR) in /Eigenmannia/, characterized by a shift in the fish's EOD frequency away from the electrical stimulus frequency, increased with rising temperature. The Q(10) of the resting EOD frequency and JAR were different in their absolute values and variation patterns with temperature. These results suggest that the neuronal mechanisms for the 2 behavioral responses are probably independent and the integration site is likely to be at the pacemaker cells.

76-000534 Glova, G. J.; McInerney, J. E. CRITICAL SWIMMING SPEEDS OF COHO SALMON (/ONCORHYNCHUS KISUTCH/) FRY TO SMOLT STAGES IN RELATION TO SALINITY AND TEMPERATURE. J. Fish. Res. Board Can. 34 (1): 151-154. Jan. 1977. In English with French summ. SFA 22(2)

[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada] Critical swimming speeds (fork lengths per second L/s) of early fry, advanced fry, and pre-smolt coho salmon /Oncorhynchus kisutch/, surpassed those of smolts. Performances were inversely related to size, varying from a peak of 7.3 L/s in fry to 5.5 L/s in smolts. In early fry to pre-smolt stages, salinity had little effect whereas in smolts a distinct maximum performance occurred near 13°/oo. Swimming performances of all stages varied directly with temperature: maxima occurred between 20 and 23°C. As temperature decreased, critical speeds of early fry declined at a faster rate than that of later stages, the values at 23 and 3°C being 7.2 and 3.5 L/s in early fry and 5.5-3.5 in smolts. This study shows that on a size-related basis underyearling coho are capable swimmers

76-000534 CONTINUED
in estuarine conditions. Thus, their apparent failure to survive premature seaward migrations cannot be explained by their inability to perform important locomotor-dependent behaviors.

76-000535 Hill, L. G.; Schnell, G. D.; Pigg, J. THERMAL ACCLIMATION AND TEMPERATURE SELECTION IN SUNFISHES (/LEPOMIS/, CENTRARCHIDAE). Southwest Nat. 20 (2): 177-184. 27 June 1975. SFA 22(2)
[Dep. Zool., Univ., Okla., Norman] Behavioral responses of five sympatric species of centrarchids were tested in a thermal gradient. Each species demonstrated a sensitivity to thermal regimes and a capability for selecting particular zones in a thermal environment. Thermal acclimation altered the level of preferred temperature among all centrarchids tested, with a positive correlation between acclimation and selected temperature. However, The degree of alteration differed appreciably among species.

76-000536 Klauda, R. J. USE OF SPACE AND TIME BY WILD, ADULT SMALLMOUTH BASS (/MICROPTERUS DOLOMIEUI/) IN A SEMI-NATURAL STREAM HABITAT. Ph. D. dissertation, Pa. State Univ. 184p. 1975. From Diss. Abstr. Int. B Sci. Eng. 37(2), 1976. SFA 22(2)
Diurnal activity of nine, wild adult smallmouth bass was observed and recorded during summer, fall and winter in a semi-natural stream habitat. The majority of time (78.9-91.1 per cent) was spent in non-movement related activites restricted to the low to moderate current velocity areas of the study stream. Movement-related activities were also restricted to low to moderate current velocity areas and diminished as water temperatures and day length decreased. Position changes accounted for 8.9-20.5 per cent of the time budget. Agonistic interactions with conspecifics accounted for less than one per cent of the time budget. Social organization in the population was based on the combination of a rather stable dominance order and a system of individual 'exclusive use spaces' which apparently moved with the individual and changed shape or expanded or contracted in size or defense intensity. High and low ranking individuals were active during different segments of the daylight period permitting maximal use of communal space with minimal aggression. Time allotted to diurnal feeding ranged from 0-0.6 per cent. Most feeding behavior was observed late in the daylight period and probably extended into the post-dusk period after observations ceased. The smallmouth bass were solitary pursuing predators and succeeded in capturing forage fish in about one of four attacks. Activity time budgets, compared to respiratory metabolism data for other freshwater fish species summarized from the literature, suggested that the smallmouth bass moderated energy expenditures by allocating the major proportion of time to low energy cost behaviors, by restricting all activity to low and moderate current velocity areas of the study stream, and by adopting a social organization and temporal activity patterns which reduced the amount of intra-group aggression.--From abstr.

76-000537 Losey, G. S., Jr. THE SIGNIFICANCE OF COLORATION IN FISHES OF THE GENUS /HYPSOBLENNIUS/ GILL. Bull. South. Calif. Acad. Sci. 5 (2): 183-198. Aug. 1976. SFA 22(2)
[Dep. Zool., Univ. Hawaii, Honolulu 96744] The social behavior and associated colorations of five Pacific species of /Hypsoblennius/ were observed under field and laboratory conditions. Behavior patterns were classified as to their functional relationship to types of behavior such as aggression and courtship. The occurrence of various color patterns was then tested for correlation to these types of behavior. This analysis indicates that coloration is of potential value as a communication signal for differentiating between submission,

76-000537 CONTINUED
aggression and courtship. Coloration was also correlated with habitat type and showed striking differences between sympatric species.

76-000538 Mapstone, G. M.; Wood, E. M. THE ETHOLOGY OF /ABUDEFDUF LURIDUS/ AND /CHROMIS CHROMIS/ (PISCES: POMACENTRIDAE) FROM THE AZORES. J. Zool. (Lond.) 175 (2): 179-199. Feb. 1975. SFA 22(2)
[E. M. Wood: Dep. Biol., Goldsmiths' Coll., London, England] The behaviour of the two species of damsel fishes found in the Azores, /Abudefduf luridus/ (Cuvier) and /Chromis chromis/ (L.) was studied using underwater techniques. /A. luridus/ is a substrate species, whereas /C. chromis/ alternates between a rock dwelling and a mid-water existence depending on its sexual condition. The male in both species sets up a breeding territory and, after spawning, cares for and protects the eggs. No pair bonds are formed. Social organization and reproductive behaviour in these two species is discussed in relation to other pomacentrids, for which comparable behaviour patterns have been reported.

76-000539 Marliave, J. B. THE BEHAVIORAL TRANSFORMATION FROM THE PLANKTONIC LARVAL STAGE OF SOME MARINE FISHES REARED IN THE LABORATORY. Ph. D. dissertation, Univ. British Columbia 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)
This study tested the hypothesis that larvae of benthic species settle only on a substrate which is typical of the adult habitat and that those which fail to encounter a suitable substrate will not settle and will die before completion of metamorphosis. A similar hypothesis, that larvae of schooling species will fail to metamorphose if they cannot express adult schooling behavior, was tested by rearing them in isolation through metamorphosis. The range of substrate preferences for settling larvae of intertidal species corresponded to the adult niche breadth. The preferred substrate for larval settlement was always an element within the adult habitat, but not necessarily the same substrate preferred by the adults. This study demonstrated that metamorphosis does not coincide with the behavioral transformation. Larvae of schooling species adopted adult schooling behavior well before the onset of their gradual metamorphosis. In intertidal species, particular metamorphic changes occurred before the settlement period, which took place more or less abruptly. Immediately after settlement, metamorphic pigmentation occurred rapidly, followed by allometric growth. One benthic species which does not tend to be sedentary as an adult metamorphosed completely before settling onto kelp. Considerable variability in the pattern of behavioral transformation and metamorphosis was witnessed between species.--From abstr.

76-000540 Milburn, O.; Alexander, R. McN. THE PERFORMANCE OF THE MUSCLES INVOLVED IN SPITTING BY THE ARCHERFISH /TOXOTES/. J. Zool. (Lond.) 180 (2): 243-251. Oct. 1976. SFA 22(2)
[Dep. Pure Appl. Zool., Univ. Leeds, Leeds, England] the Archerfish /Toxotes/ knocks aerial insects into the water by spitting at them. Spitting has been filmed and the excess pressure in the orobranchial cavity is estimated from the muzzle velocity as 7.2 kN m^{-2}. A dissection of the head shows that the adductor arcus palatini and geniohyoideus are most likely to be involved in spitting. From measurements made of these muscles, it is calculated that stresses up to at least 210 kN m^{-2} must act in them during spitting. Further, it appears from the calculations that these muscles must shorten at rates of 2.4-3.0 muscle length sec^{-1}, which seems unlikely at such high stresses. It is possible that a catapult mechanism may be involved.

76-000541 Peterson, S. E.; Schutsky, R. M. SOME RELATIONSHIPS OF UPPER THERMAL TOLERANCES TO PREFERENCE AND AVOIDANCE RESPONSES OF THE BLUEGILL. IN G. W. Esch and R. W. McFarlane, eds. Thermal Ecology II. U.S. Energy Res. Dev. Admin. Symp. Ser. 40 (CONF-750-425). Natl. Tech. Info. Serv., Springfield, VA. 148-153. 1976. SFA 22(2)

[Ichthyological Assoc., Inc., P.O. Box 12, drumore, PA 17518] Temperature tolerance, preference, and avoidance studies were conducted on the bluegill (/Lepomis macrochirus/) in Conowingo Pond, lower Susquehanna River, Pa. Upper incipient lethal temperatures of 23.3, 29.3, and 35.8°C were determined for bluegill (mean total length 90 mm) acclimated at 1, 13, and 27°C, respectively. The results agree with published information on bluegill. Median resistance temperatures were plotted against linear regressions of preference and avoidance temperatures. Preferred temperatures were 4 to 5°C less than median resistance temperatures. Bluegill acclimated at temperatures ≥ 13°C avoided short-term (96 hr) lethal temperatures. Median resistance time for bluegill acclimated at 13 and 27°C leveled off and exceeded 96 hr near the avoidance temperature. Avoidance temperatures exceeded lethal temperatures at acclimation temperatures less than 13°C. No mortality occurred with bluegill acclimated at 1°C and subjected to a temperature differential ≤ 21°C. Low thermal responsiveness was observed most frequently in avoidance studies conducted at acclimation temperatures less than 10°C and in preference studies conducted at acclimation temperatures less than 20°C.

76-000542 Russell, B. C.; Allen, G. R.; Lubbock, H. R. NEW CASES OF MIMICRY IN MARINE FISHES. J. Zool. (Lond.) 180 (3): 407-423. Nov. 1976. SFA 22(2)

[Australian Mus., Sydney, N.S.W., Australia] Ten new cases of mimicry in marine fishes are described. Mimicry amongst marine fishes appears to be a general and widespread phenomenon. Present examples suggest that there may be varying degrees of resemblance; in some cases the mimic-model relationship is loose and facultative while in others it appears to be highly co-evolved and obligative.--From abstr.

76-000543 Sale, P. F. PATTERNS OF USE OF SPACE IN A GUILD OF TERRITORIAL REEF FISHES. Mar. Biol. 29 (1): 89-97. 21 Feb. 1975. SFA 22(2)

[Sch. Biol. Sci., Univ. Sydney, Sydney, N.S.W., Australia] There exists on Heron Reef, at the southern end of the Great Barrier Reef, an 8-species guild of ecologically very similar, territorial, herbivorous reef fishes. All individuals of these species maintain territories on rubble substrata throughout juvenile and adult life. Territories are defended from all other guild members. Three rubble patches, each containing residents of 3 guild species: /Pomacentrus apicalis/, /p. wardi/, and /Abudefduf lachrymatus/, have been monitored for 12 to 18 months. The 3 species show similar preferences for space as colonists, although adult and juvenile colonists behave differently. Numbers of colonists detected on rubble patches are not proportional to the resident populations of the 3 species. Residents of the 3 species are equal in their abilities to enter spaces vacated through mortality, although they differ slightly in methods used to enter sites. They do not respond preferentially to sites previously occupied by any particular species. /P. wardi/ shows a higher rate of mortality than the other species, and residents of this species are more often dislodged by new colonists. The total amount of space held on any rubble patch did not vary during the year from September, 1972 to October, 1973. The data are interpreted as supporting the hypothesis that the 3 species do not differ in their requirements for space on rubble patches, and that they are in competition for a short

76-000543 CONTINUED
supply of such space. Differences exist in their strategies for obtaining and holding such space.--From abstr.

76-000544 Sohn, J. J. SOCIALLY INDUCED INHIBITION OF GENETICALLY DETERMINED MATURATION IN THE PLATYFISH, /XIPHOPHORUS MACULATUS/. Science 195 (4274): 199-201. 14 Jan. 1977. SFA 22(2)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138] Maturation in /Xiphophorus maculatus/ (Pisces: Poeciliidae) is under control of the sex-linked /P/ gene. However, when two individuals are reared together the socially dominant individual delays the maturation of the subordinate. Nevertheless, it is not a requirement that a fish be socially dominant to become mature. The data suggest that inhibition of maturity takes place when an individual is not dominant at a time near the genetically determined age of maturation. Two hypotheses are offered to explain these results.

76-000545 Timms, A. M. INTRASPECIFIC COMMUNICATION IN GOLDFISH. J. Fish Biol. 7 (3): 377-389. May 1975. SFA 22(2)
[Conserv. Counc. Ontario, 45 Charles St., E. Toronto, ON, Canada] Characteristics of locomotor behaviour of goldfish (/Carassius auratus/) were monitored automatically and the response to sensory cues provided by conspecifics was analysed. Goldfish were attracted to free-swimming conspecifics and oriented to them klinokinetically by decreasing their mean angle size of turns and increasing both their turning frequency and mean step length between turns. These locomotor changes were stimulus bound. Although the responses were mediated visually, blinded goldfish, which were not overtly attracted, nevertheless oriented orthokinetically to non-visual cues from the conspecific. Simulation of the conspecific by models demonstrated that oval and horizontal rectangular shapes of the same area and their size interactions, elicited significant attraction whereas square and vertical rectangular shapes of the same area did not. Increasing speeds and/or size of the model tended to bring about stronger attraction.

76-000546 Willoughby, N. G. THE BUOYANCY AND ORIENTATION OF THE UPSIDE-DOWN CATFISHES OF THE GENUS /SYNODONTIS/ (PISCES: SILUROIDEI). J. Zool. (Lond.) 180 (3): 291-314. Nov. 1976. SFA 22(2)
[Fish. Res. Unit, Makhanga, Chiramo, Malawi] The forces involved in the buoyancy of the genus /Synodontis/ are unusually large owing to the well-developed cephalo-nuchal shield possessed by all members of the genus, and the large swim bladder and high levels of body fat needed to counteract this. A new method of determining the quantity of crude lipid in the tissues was developed and tested against a recognized method. Negative correlations were found between the total quantities of fat present and the volumes of the swim bladder for several species. Two species which maintained neutral buoyancy but occupied different ecological niches were found to achieve neutrality by different means, one possessing an abnormally large swim bladder and the other very large quantities of fat. Several species of this genus regularly invert and swim on their backs. Several possible causes of inversion were investigated, including both physical and behavioural factors. The position of the food source was found to be the most important factor. By manipulating this it was possible to persuade normally orientating species to invert, and inverting species to return to normal orientation. Three theories to explain the inverting habit are advanced and their merits discussed.--From abstr.

LIFE HISTORIES-GENERAL WORKS

76-000547 Balon, E. K. THE EELS OF LAKE KARIBA: DISTRIBUTION, TAXONOMIC STATUS, AGE, GROWTH AND DENSITY. J. Fish Biol. 7 (6): 797-815. Nov. 1975. SFA 22(2)

[Dep. Zool., Univ. Guelph, Guelph, ON, Canada] It has been predicted that eels would disappear from Lake Kariba because juveniles would be unable to surmount the dam which was closed in 1958. This prediction has been proved wrong. In 1970-71 an abundant population of eels was discovered in the lake, mostly at depths from 25-40 m. The eels have intermingled characters of both the mottled /Anguilla nebulosa labiata/ and the plain-colored /A. mossambica/. A clear separation of these two taxa was impossible and therefore conspecific status of these two species is suspected; the name /A. n. labiata/ is retained for the population. The age structure of the eel cohorts suggests that juveniles surmount the dam in their second year of life and then spend approximately 7 years in streams of the lake drainage. The fastest maturing individuals which are in best condition then emigrate to the ocean, whereas the slower maturing eels remain in the lake longer. The oldest eel in the samples was 18 years old. The catch per unit of effort for hoopnets was 2.35 kg in the upper part of the lake and 0.41 kg for the lower part of the lake. The density at Namazambwe was assessed at 46 eels per 1 ha. The unexploited eel population of Lake Kariba could form a valuable resource.

76-000548 Bruton, M. N.; Boltt, R. E. ASPECTS OF THE BIOLOGY OF /TILAPIA MOSSAMBICA/ PETERS (PISCES:CICHLIDAE) IN A NATURAL FRESHWATER LAKE (LAKE SIBAYA, SOUTH AFRICA). J. Fish Biol. 7 (4): 423-445. July 1975. SFA 22(2)

[Inst. Freshwater Stud., Lake Sibaya Res. Stn., P.O. Ubombo, Kwazulu, South Africa] An account is given of some aspects of the biology of /Tilapia mossambica/ Peters in Lake Sibaya, South Africa. Lake Sibaya is a warm shallow coastal lake with extensive shallow terraces in the littoral which shelve abruptly into underwater valleys. The substrate is predominantly sandy. Aquatic macrophytes are generally restricted to water 1-7 m deep. Adult fishes (over 8 cm standard length) are usually absent from water deeper than 12 m and shallower than 0.5 m, whereas juveniles may occur at all depths, and fry only in very shallow water. /T. mossambica inhabits the littoral and sublittoral in the warm and transition periods (August-April) but moves into deep water in the cool season (May-July). Exposed and sheltered areas are utilized for different purposes by adult fishes, the former for nesting, and latter for feeding and mouth-brooding. Habitat selection by males is governed by the availability of suitable nest sites. Nests are most common in sparsely-vegetated sheltered areas. Brooding females preferred sheltered littoral areas but ventured onto the terrace to release the fry. Juveniles and fry inhabited exposed shores with a temperature gradient which reversed diurnally. The breeding, shoaling and feeding behaviour is described. The biology of /T. mossambica/ in lake Sibaya is compared to data on the same, and similar species, in other systems. The utilization of available resources in the lake by /T. mossambica/ is discussed and reference is made to the importance of the retention of generalized characters for the successful habitation of the cyclically-renewed habitat of the littoral.

76-000549 Carscadden, J. E.; Leggett, W. C. LIFE HISTORY VARIATIONS IN POPULATIONS OF AMERICAN SHAD, /ALOSA SAPIDISSIMA/ (WILSON), SPAWNING IN TRIBUTARIES OF THE ST. JOHN RIVER, NEW BRUNSWICK. J. Fish Biol. 7 (5): 595-609. Sept. 1975. SFA 22(2)

[W.C. Leggett: Dep. Biol., McGill Univ., Montreal, PQ H3C 3G1, Canada] Shad were sampled at four locations in the St. John River area, New Brunswick; St. John Harbour, Kennebecasis River, Washademoak Lake and Mactaquac Dam. The effect of the St. John Harbour fishery on upstream spawning populations was minimal. Mactaquac Dam began operation in 1967 and since that time the populations of shad arriving at that facility have been in a state of flux. When shad populations from Kennebecasis River and Washademoak L. were compared, the Washademoak Lake population exhibited higher relative fecundity, lower mean age at maturity and possessed a lower proportion of repeat spawners. The combinations of reproductive characteristics occurring in the populations of the St. John River were the same as those occurring over the Atlantic coast range of shad. The possible environmental factors influencing the variations in reproductive characteristics are discussed.

76-000550 Coulter, G. W. THE BIOLOGY OF /LATES/ SPECIES (NILE PERCH) IN LAKE TANGANYIKA, AND THE STATUS OF THE PELAGIC FISHERY FOR /LATES/ SPECIES AND /LUCIOLATES STAPPERSII/ (BLGR.). J. Fish Biol. 9 (3): 235-259. Sept. 1976. SFA 22(2)

[UNDP/FAO Fish. Res. Proj. Lake Tanganyika, Bujumbura, Burundi]

76-000551 Crone, R. A.; Bond, C. E. LIFE HISTORY OF COHO SALMON, /ONCORHYNCHUS KISUTCH/, IN SASHIN CREEK, SOUTHEASTERN ALASKA. NOAA Fish. Bull. 74 (4): 897-923. Oct. 1976. SFA 22(2)

[1211 Snipes St. West, The Dalles, OR 97058] The freshwater life of coho salmon, /Ohcorhynchus kisutch/, in Sashin Creek, Southeastern Alaska, was studied from the fall of 1963 through the summer of 1968. Additional information on age composition and fecundity of adults returning to Sashin Creek and a nearby stream was collected through the fall of 1972. Some pre-1963 data on coho salmon entering and leaving Sashin Creek were used. Wier counts and estimates of numbers of adult salmon determined from spawning ground counts and mean redd life were poor measures of the total escapement of coho salmon in Sashin Creek; an estimate made from tagging a portion of the escapement and subsequently determinating tagged-to-untagged ratios of spawners on the riffles proved to be a more reliable measure. The number of spawning coho salmon varied for the years 1963 through 1967 from 162 to 916; the dominant age group was 4(3). The salinity of the surface water of the estuary of Sashin Creek usually is less than 10-15°/oo; bioassays of salinity tolerance indicated that coho salmon fry can survive in these salinities. In 1974, 44,000 coho salmon fry migrated to the estuary soon after emergence, although none of the scales collected from returning spawners in subsequent years showed less than 1 yr of freshwater residence. Survival curves constructed from periodic estimates of the stream populations of juvenile coho salmon for the years 1964-67 showed that mortality was highest in midsummer of the first year of life, when 62 percent to 78 percent of the juveniles were lost in a 1-mo period. Most coho salmon smolts migrated from Sashin Creek in late May or early June. In the spring of 1968, 1,440 smolts left Sashin Creek--37 percent were yearlings, 59 percent were 2-yr-olds, and 4 percent were 3-yr-olds. The average fork lengths were 83 mm for yearlings, 105 mm for 2-yr-olds, and 104 mm for 3-yr-olds.

76-000552 Gee, J. M. THE GENUS /XENOCLARIAS/ (PISCES, SILURIFORMES) IN LAKE VICTORIA, WITH A REDESCRIPTION OF /XENOCLARIAS EUPOGON/ AND NOTES ON THE BIOLOGY OF THE SPECIES. J. Zool. (Lond.) 175 (2): 201-217. Feb. 1975. SFA 22(2)

[Inst. Mar. Environ. Res., 67/69 Citadel Rd., Plymouth, England] The acquisition of large collections of the catfish /Xenoclarias/ Greenwood from Lake Victoria, East Africa, deomonstrated a need for a reappraisal of the taxonomy of the genus. It is suggested that only one species, /Xenoclarias eupogon/ (Norman) is found in the lake but that it is very variable in many of its morphometric characters. The species is redescribed from data obtained for 72 fishes from various localities and depths in the lake. Observations of the food of the fish show it to be almost entirely insectivorous with a preference for Chironomidae over Chaoboridae larvae. Evidence is also put forward to support the view that /X. eupogon/ breeds on or close to rocky shores.

76-000553 Haedrich, R. L.; Polloni, P. T. A CONTRIBUTION TO THE LIFE HISTORY OF A SMALL RATTAIL FISH, /CORYPHAENOIDES CARAPINUS/. Bull. South. Calif. Acad. Sci. 75 (2): 203-211. Aug. 1976. SFA 22(2)

[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543] The North Atlantic macrourid /Coryphaenoides/ (/Lionurus/) /carapinus/ lives between about 1200 and 2800 m off southern New England, with greatest abundance of about 2.4 individuals/1000 m² in the transition zone from slope to rise. Larger individuals, mostly female, tend to live at greater depths. Winter spawning is indicated, with 50,000 to 220,000 0.5-mm eggs being produced per female. Eighty-four of 108 stomachs examined contained food. Benthic invertebrates were most important in the diet, and there was little change in food with growth. The fish feeds selectively on the ophiuroid /Ophiura ljungmani/. The subgenera /Nematonurus/, /Chalinura/, and /Lionurus/ of /Coryphaenoides/ seem to occupy overlapping yet distinct adaptive zones, with different prey and foraging area important considerations.

76-000554 LeDrew, B. R.; Green, J. M. BIOLOGY OF THE RADIATED SHANNY /ULVARIA SUBBIFURCATA/ STORER IN NEWFOUNDLAND (PISCES: STICHAEIDAE). J. Fish Biol. 7 (4): 485-495. July 1975. SFA 22(2)

[Dep. Environ., Fish. Mar. Serv., Ottowa K1A 0H3, Canada] /Ulvaria subbifurcata/ is found on the north-east Atlantic coast of North America. Fish less than 55 mm preyed prodominantly on copepods, while larger ones ate mainly nereids; polynoids and amphipods were eaten by all sizes. These four food items comprised the main food of the radiated shanny. Spawning occurred in May with the fish first spawning at age three to five. No conspicuous secondary sexual characters were observed. Females spawned once per year, producing a demersal egg mass. Males spawned up to four times and tended the egg mass (or masses). Incubation lasted 35-40 days, and the pelagic larvae settles on the bottom by August. Adult males tended to be larger than females of the same age but little difference was found sexually in the length-weight relationships. /Ulvaria subbifurcata/ larger than 60 mm are nocturnal. This may reduce predation by, and competition with, other inshore benthic fishes.

76-000555 Manooch, C. S. III A STUDY OF THE TAXONOMY, EXPLOITATION, LIFE HISTORY, ECOLOGY AND TAGGING OF THE RED PORGY, /PAGRUS PAGRUS/, LINNAEUS OFF NORTH CAROLINA AND SOUTH CAROLINA. Ph. D. dissertation, N.C. State Univ. 286p. F1975. From Diss. Abstr. Int. B Sci. Eng. 37(1), 1976. SFA 22(2)

The red porgy, /Pagrus sedecim/ Ginsburg, is placed in the synonomy of /Pagrus pagrus/ Linnaeus, based on External meristics, Proportional body measurements, diagnostic radiographs, and electrophoretic analysis. Off the Carolinas /Pagrus pagrus/ supports a thriving recreational fishery which from 1972 through 1974 harvested approximately 705,300 individuals weighing 1.7 million pounds. The average red porgy was 425.4 mm total length, weighed 2.25 pounds (1.0 kg) and was five years old. Females were more abundant in the catch, although only 5.4 percent were sexually immature. Neither biological data nor catch statistics suggest a need for changes in methods of harvest, or restriction on size or number of individuals caught in order to maintain the current yield. Red porgy are fully recruited into the recreational fishery at age V. Total annual mortality ranged from 32 to 55 percent. Spawning occurs from January through April in waters ranging from 15 to 100 fathoms in depth with bottom temperatures from 16.4°C to 21.5 C. /Pagrus pagrus/ is an opportunistic browser which feeds primarily on crustaceans, mollusks, and echinoderms. The species is generally associated with two types of habitat: inshore live-bottom, 13 to 23 fathoms, and the shelf-edge in 28 to 70 fathoms. Results of preliminary tagging indicated a low rate of return, 0.71 percent, probably reflecting a loss of tags rather than a low level of fishing intensity. The average fish tagged returned was at liberty for 120 days, and moved only 3.67 miles from the original tagging site.--From abstr.

76-000556 Mitchell, R. W.; Russell, W. H.; Elliott, W. R. MEXICAN EYELESS CHARACIN FISHES, GENUS /ASTYANAX/: ENVIRONMENT, DISTRIBUTION, AND EVOLUTION. Spec. Publ. Mus. Texas Tech. Univ. No. 12. 89p. Feb. 1977. SFA 22(2)

[Museum, Texas Tech. Univ., Lubbock 79409]

76-000557 Robbins, W. H.; MacCrimmon, H. R. VITAL STATISTICS AND MIGRATORY PATTERNS OF A POTAMODROMOUS STOCK OF SMALLMOUTH BASS, /MICROPTERUS DOLOMIEUI/. J. Fish. Res. Board Can. 34 (1): 142-147. Jan. 1977. In English with French summ. SFA 22(2)

[Sault Coll. Appl. Arts Technol., Sault Ste. Marie, ON P6A 5L3, Canada] Between 1968 and 1971, upriver movement of bass from Lake Simcoe was highly correlated with water temperature and discharge (/r/ = 0.704, /P/ less than .001). Vital statistics and growth were similar to lacustrine and riverine stocks at similar latitude. Total annual mortality averaged 0.56 with 65 percent attributable to angler exploitation, principally in the river. Some 34 percent (after mortality) river spawners returned upriver in subsequent years. Repeat spawners (65 percent female) comprised an average 19 percent of the spawning runs. Most adults moved downriver in late June and July when water temperatures approached 25°C. Adults remaining in the spawning area experienced water temperatures to 29°C before emigrating during freshets in July and August. Lake migrants intermingled on shoal areas with lacustrine and possibly other potamodromous stocks each summer.

76-000558 Rohde, F. C.; Arndt, R. G.; Wang, J. C. S. LIFE HISTORY OF THE FRESHWATER LAMPREYS, /OKKELBERGIA AEPYPTERA/ AND /LAMPETRA LAMOTTENII/ (PISCES: PETROMYZONIDAE), ON THE DELMARVA PENINSULA (EAST COAST, UNITED STATES). Bull. South. Calif. Acad. Sci. 75 (2): 99-111. Aug. 1976. SFA 22(2)

[Inst. Mar. Sci., Univ. N. Car., Morehead City 28557] We studied the life history of the least brook lamprey, /Okkelbergia aepyptera/, and the American brook lamprey, /Lampetra lamottenii/, in Delaware. Observations of nest construction and spawning in /O. aepyptera/ are presented. Mean number of eggs per female is 874. Larvae average 3.40 mm TL at hatching. Analysis of length-frequency data for ammocoetes indicates that the duration of the larval period is at least 5.4 years. Length-weight equation for ammocoetes is Log W = -5.27 + 2.73 Log L. Meristic data are presented. Mean number of eggs in /L. lamottenii/ is 1691. Larvae average 2.60 mm TL at hatching. Ammocoete length-weight equation is Log W = -5.31 + 2.76 Log L. Comparisons are made with northern populations.

76-000559 Schenck, J. R.; Whiteside, B. G. DISTRIBUTION, HABITAT PREFERENCE AND POPULATION SIZE ESTIMATE OF /ETHEOSTOMA FONTICOLA/. Copeia. 1976 (4): 697-703. 30 Dec. 1976. SFA 22(2)

[Aquatic Stn., Texas State Univ., San Marcos 78666] /Etheostoma fonticola/ is an endangered species of fish living only in the San Marcos and Comal rivers, Texas, and the Dexter National Fish Hatchery, New Mexico. This species was reintroduced into the Comal River after extensive sampling revealed its absence, and introduced into the Dexter fish hatchery for protection and propagation. /E. fonticola/ was collected only in vegetated habitats. The habitats preferred by most of the fish had vegetation that grew close to the substrate; specifically, /Rhyzoclonium/ sp. A conservative rough estimate of the number of /E. fonticola/ living in the San Marcos River watershed was 103,000.

76-000560 Weaver, R. O.; Ziebell, C. D. ECOLOGY AND EARLY LIFE HISTORY OF LARGEMOUTH BASS AND BLUEGILL IN IMPERIAL RESERVIOR, ARIZONA. Southwest. Nat. 21 (2): 151-160. 25 June 1976. SFA 22(2)

[U.S. FWS, River Basin Stud., Portland, OR 97232] Largemouth bass and bluegills were studied during their first year of life to determine the significance of selected ecological factors related to their wellbeing. Factors selected included habitat requirements, food habits, and growth rates of juvenile fish. Some pre-juvenile fish data were collected on the bottom types of spawning area and during spawning periods. An evaluation of the environmental conditions in the lakes is presented.

POPULATION STUDIES, PRODUCTION, ETC.

76-000561 Ayles, H. A. LAKE WHITEFISH (/COREGONUS CLUPEAFORMIS/ (MITCHILL)) IN SOUTHERN INDIAN LAKE, MANITOBA. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 640. vi + 28p. 1976. In English with French summ. SFA 22(2)

[Environ. Can., Fish. Mar. Serv., Freshwater Inst., Winnipeg, MB, Canada] The spawning and population characteristics of lake whitefish (/Coregonus clupeaformis/), from Southern Indian Lake, are discussed. Whitefish spawn in shallow areas of rock and boulders. Temperature appears to trigger the spawning act. Whitefish (males and females) mature at an average age of 8.8 years. Growth and condition are good for lake whitefish in most regions of this large and complex lake.

76-000561 CONTINUED
Different year class strengths appear to exist. Mortality rates vary from 0.43-0.70. The flow of the Churchill River through this lake has a strong influence on the productivity of the lake and therefore on the available commercial yield of whitefish. Commercial fishing of whitefish yields, on the average, 400,000 kilograms per year.

76-000562 Bisson, P. A.; Davis, G. E. PRODUCTION OF JUVENILE CHINOOK SALMON, /ONCORHYNCHUS TSHAWYTSCHA/, IN A HEATED MODEL STREAM. NOAA Fish. Bull. 74 (4): 763-774. Oct. 1976. SFA 22(2)
[Weyerhaeuser Company, Longview, WA 98632] Temperature was elevated approximately 4°C in a model stream, compared with an unheated but otherwise similar control stream. The streams were located outdoors and received identical amounts of exchange water from a nearby creek. Diel and seasonal temperature fluctuations were similar to those of area streams. Juvenile spring chinook salmon, /Oncorhynchus tshawytscha/, were introduced into each stream either as eyed eggs or fry and allowed to remain for approximately 1 yr. Two consecutive year classes of juvenile salmon were studied. Their production was measured triweekly and related to changes in temperature, food availability, and other environmental factors. Ancillary experiments utilizing water from the model streams permitted measurement of differences in growth rate of salmon fed various rations. Salmon production in the control stream exceeded that in the heated stream. In 1972, total production in the control stream was twofold greater and, in 1973, it was approximately 30 percent greater than in the heated steam. Elevated temperature resulted in reduced growth rates of the fish especially as food became less abundant and at times also resulted in lower biomasses of food organisms, either because the temperature increase directly affected survival and growth of benthic invertebrates or because increased sedimentation associated with heavier growth of filamentous algae made riffle substrate less suitable for certain species. Beneficial effects of increased temperature appeared to include protection from infestation by a trematode parasite (/Nanophyetus salmincola/) and, possibly, increased tendencies of some invertebrates to enter the drift.

76-000563 Clady, M. D. EARLY SURVIVAL AND RECRUITMENT OF SMALLMOUTH BASS IN NORTHERN MICHIGAN. J. Wildl. Manage. 39 (1): 194-200. Jan. 1975. SFA 22(2)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853] Survival for six life-history stages from egg to fall fingerling was estimated for the 1967, 1968, and 1969 cohorts of smallmouth bass (/Micropterus dolomieui/) in Katherine Lake in the Upper Peninsula of Michigan near the northern limit of the species' range. The percentages of egg potentials that were deposited on nests were low (15-34 percent). Survival between egg deposition and the post-larval stage was consistent in all years (26-33 percent). Although there was no correlation between first-year survival of the 1967-69 year classes and temperature, there was a significant correlation between strength of the 1959-66 year classes (as estimated from adjusted population numbers at age IV) and air temperature during the first summer of life. Since dominant year classes produced in the three years (1959, 1963, and 1966) which had the warmest June-October temperatures contributed greatly to the correlation, the discrepancy between the 1959-66 and 1967-69 data probably resulted from the lack of overall average or above-average temperatures during any year of the latter period.

76-000564 Crisp, D. T.; Mann, R. H. K.; McCormack, J. C. THE POPULATIONS OF FISH IN THE RIVER TEES SYSTEM ON THE MOORE HOUSE NATIONAL NATURE RESERVE, WESTMORLAND. J. Fish Biol. 7 (5): 573-593. Sept. 1975. SFA 22(2)

[Freshwater Biol. Assoc., The Ferry House, Far Sawrey, Ambleside, Westmorland, England] the age, growth, population densities and annual production of an isolated population of brown trout (/Salmo trutta/ L.) and bullhead (/Cottus gobio/ L.) were investigated over a 5 year period in Trout Beck in the northern Pennines. Additional data were obtained from two other sites; Great Dodgen Pot Sike and the River Tees. Trout growth rates were low, particularly in Dodgen Pot Sike, but ages up to VIII were recorded. Bullhead growth rates were similar to those in the Tees at Cow Green, though the Moor House bullheads had a higher survival rate. Population densities of trout ranged from 0.10-0.22/m^2, with a fry contribution of 0-80 percent. The bullhead population in Trout Beck was sparse, generally 0.1/m^2, though an 0 group value of 0.46/m^2 was estimated in 1967. At Tees Bridge values ranged from 2.5-7.8/m^2. Most trout matured by age III, though in Great Dodgen Pot Sike only half of the females were mature at age IV. Annual production was estimated from Allen graphs. Trout production ranged from 1.02-3.50 g/m^2/year, the fry contributing up to 51.5 percent of the total. A value of 0.48 g/m^2/year was obtained for bullheads in the Trout Beck system in a year of good recruitment, whilst bullhead production at Tees Bridge was 7.43 g/m^2/year, with fry and I group contributing 48.7 and 37.5 percent respectively. The high survival rate, irregular recruitment, and poor growth of these high altitude populations is discussed. Growth and reproductive peculiarities of the Great Dodgen Pot Sike trout are also discussed.

76-000565 Naiman, R. J. PRODUCTIVITY OF A HERBIVOROUS PUPFISH POPULATION (/CYPRINODON NEVADENSIS/) IN A WARM DESERT STREAM. J. Fish Biol. 9 (2): 125-137. Aug. 1976. SFA 22(2)

[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331] Production and food intake by an herbivorous pupfish population (/Cyprinodon nevadensis amargosae/) living in the outflow of a thermal artesian well (Tecopa Bore) near Death Valley, California is described. Water issues from the ground at 47.5° C and cools 8-12° C before leaving the study area 300 m from the source. High stream temperatures restricted the pupfish population to some 41 percent of the study area, with a resulting mean density of 89 individuals m^{-2} (range = 13 to 196 m^{-2}). Biomass estimates ranged from 7 kcal m^{-2} to 42 kcal m^{-2}. The mean annual standing crop of pupfishes (24 kcal m^{-2}) turned over about five times annually. Growth rates were highest in juveniles (mean = 9.5 percent day^{-1}) and slowest in large abults (mean = 0.8 percent day^{-1}). Monthly production ranged from 22 kcal m^{-2} in September to 3 kcal m^{-2} in July and August. Pupfish in Tecopa Bore fed on algae and detritus, ingesting 1941 kcal m^{-2} yr^{-1} or 17.5 percent of the annual net primary production. 119 kcal m^{-2} yr^{-1} was deposited in growth. This value is approximately ten times greater than values previously reported for large carnivorous fishes but is comparable to values reported for herbivorous fishes under pond culture.

76-000566 Nakashima, B. S.; Gascon, D.; Leggett, W. C. SPECIES DIVERSITY OF LITTORAL ZONE FISHES ALONG A PHOSPHORUS-PRODUCTION GRADIENT IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT. J. Fish. Res. Board Can. 34 (1): 167-170. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Biol., McGill Univ., Montreal, PQ H3A 1B1, Canada] The species diversity of littoral zone fish communities in four areas of Lake Memphremagog was positively related to known phosphorus and primary production gradients along the north-

76-000566 CONTINUED
south axis of the lake and to the associated north-south differences in macrobenthic and fish biomass. The highest diversity values were found consistently in the highly productive southern areas of the lake and the lowest values in the least productive northern areas.

76-000567 Paragamian, V. L.; Coble, D. W. VITAL STATISTICS OF SMALLMOUTH BASS IN TWO WISCONSIN RIVERS, AND OTHER WATERS. J. Wildl. Manage. 39 (1): 201-210. Jan. 1975. SFA 22(2)

[Chariton Res. Stn., Red Haw State Park, R.R. 1, Chariton, IA 50049] smallmouth bass (/Micropterus dolomieui/) in the Red Cedar and Plover Rivers, Wisconsin, and other populations have similar characteristics of the populations and fisheries, including body-scale relationships, food (mainly fish, crayfish, and insects), restricted movement, total annual mortality rates exceeding 50 percent, catch per unit effort of about 8 bass/100 rod hours, harvest of about 5 kg/ha (4.5 lb/acre), and an age and size structure of both population and catch consisting mainly of young, small fish. Mark-recapture population estimates, which are difficult to compare among studies for several reasons, averaged 125 bass/ha and 16.3 kg/ha in the two Wisconsin rivers. Growth was greater in the Red Cedar River than in most other populations. Fishing mortality exceeded natural mortality in six of seven populations for which data were available; in the Red Cedar River annual fishing and natural mortality rates were 34 and 31 percent, respectively. Calculation of critical size and equilibrium yield per unit recruitment indicated that the age and size structure of the population and weight harvested could be increased if a minimum length regulation were imposed on the smallmouth bass fishery in the Red Cedar River.

76-000568 Pemberton, R. SEA TROUT IN NORTH ARGYLL SEA LOCHS, POPULATION, DISTRIBUTION AND MOVEMENTS. J. Fish Biol. 9 (2): 157-179. Aug. 1976. SFA 22(2)

[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland] Sea trout were sampled by shore seining in the sea lochs of the west coast of Scotland between 1970 and 1974. This area is of special interest because of the indentation of the coastline and the varying degree of freshwater and marine influence in the sea lochs. The majority of fish caught were in their first year after smolt migration. These post-smolts were caught mainly in May and June, after which the number of trout present was low until fish at the 'whitling' stage appeared in the catches at the end of August, continuing through to the following spring. An additional recruitment of mainly unsilvered young trout from the rivers to the sea lochs was found in the autumn. Age and sex composition of both spring and autumn recruits, and of mature fish, were investigated and compared. A total of 3228 sea trout were tagged, With 311 recaptures. These recaptures supported the evidence from smolt trapping and beach seine catches that, in the first post-migration year, the smolts migrate from the rivers from late March to early May, they then migrate from the sea lochs in May and June and return in late summer and autumn.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

76-000569 Borowsky, R.; Khouri, J. PATTERNS OF MATING IN NATURAL POPULATIONS OF /XIPHOPHORUS/ II. /X. VARIATUS/ FROM TAMAULIPAS, MEXICO. Copeia. 1976 (4): 727-734. 30 Dec. 1976. SFA 22(2)
[Dep. Biol., N. Y. Univ., 952 Brown, New York 10003] The mating structure of populations of /Xiphophorus variatus/ was reconstructed in part by a genetic analysis of the progeny of females inseminated in nature. It was found that gravid females frequently remate. Genetic markers used in the analysis control pigmentation and were found to be subject to mating selection. At one of two localities studied, females lacking tailspot patterns remated more frequently than those possessing them. Males with tailspot patterns, however, were significantly more successful with females than were males lacking patterns. The sex-linked markers employed in this study can be found linked to the X or the Y chromosome. Non-random distribution of the markers among the X and Y chromosome sets (i.e., linkage disequilibrium) was observed. Apparent patterns of mating discrimination on the part of females that would account for the observed linkage disequilibrium were observed as well. In one of the two localities the Gn pattern is much rarer than expected on the basis of allelic frequencies. It is suggested that it is incompletely penetrant in that area.

76-000570 Fishelson, L. SPAWNING AND LARVAL DEVELOPMENT OF THE BLENNID FISH, /MEIACANTHUS NIGROLINEATUS/ FROM THE RED SEA. Copeia. 1976 (4): 798-800. 30 Dec. 1976. SFA 22(2)
[Dep. Zool., Tel Aviv Univ., Tel Aviv, Israel]

76-000571 Foltz, J. W. FECUNDITY OF THE SLIMY SCULPIN, /COTTUS COGNATUS/, IN LAKE MICHIGAN. Copeia. 1976 (4): 802-804. 30 Dec. 1976. SFA 22(2)
[Environ. Popul. Org. Biol., Univ. Colo., Boulder 80302]

76-000572 Fuller, J. D.; Scott, D. B. C.; Fraser, R. THE REPRODUCTIVE CYCLE OF /COREGONUS LAVARETUS/ (L) IN LOCH LOMOND, SCOTLAND, IN RELATION TO SEASONAL CHANGES IN PLASMA CORTISOL CONCENTRATION. J. Fish Biol. 9 (2): 105-117. Aug. 1976. SFA 22(2)
[Zool. Dep., Univ. St. Andrews, Scotland] Spawning takes place during the first 3 weeks of January, on offshore gravel banks. Males congregate on the spawning-grounds throughout the spawning period, while ripe females cruise in unisexual shoals in deeper water. Individual females migrate to the spawning-grounds as ovulation takes place, spawn, and return to deep water. After spawning, the gonadosomatic ratio and somatic condition factor of both sexes decrease until June or July. Gonad recrudescence occurs in males between July and October, and in females between July and December. The somatic condition factor of both sexes rises from its minimum in June or July to its maximum in September. A competitive protein binding assay was used to determine cortisol levels in 0.1 ml plasma samples of individual fish. The lowest cortisol levels occurred in fish caught by seine-netting and killed immediately by anaesthesia in MS 222 (Sandoz). Seine-netting and killing by concussion induced higher cortisol levels, in the range of 3-5 ug/100 ml. Cortisol levels in fish caught by gill-netting for 18 h were 3-6 times higher than in seine-netted fish, and the method of killing was immaterial in this case. The length of time spent in the gill-net had no significant effect on cortisol level, but maintenance of the fish in aquaria for 24-80 h elicited high cortisol levels of over 50 ug/100 ml. Post-

24-80 h el CONTINUED
mortem delay before blood-sampling resulted in lowered cortisol levels. Seasonal variations in cortisol level were determined in gill-netted fish throughout the year, and in seine-netted fish when available. Cortisol levels were high in both sexes in Spetember; and very high in ovulating females caught on the spawning-grounds, though not in ovulating females caught off the spawning-grounds.--From abstr.

76-000573 Goldberg, S. R. SEASONAL SPAWNING CYCLES OF THE SCIAENID FISHES /GENYONEMUS LINEATUS/ AND /SERIPHUS POLITUS/. NOAA Fish. Bull. 74 (4): 983-984. Oct. 1976. SFA 22(2)
[Dep. Biol., Whittier Coll., Whittier, CA 90608]

76-000574 Manooch, C. S. III REPRODUCTIVE CYCLE, FECUNDITY, AND SEX RATIOS OF THE RED PORGY, /PAGRUS PAGRUS/ (PISCES: SPARIDAE) IN NORTH CAROLINA. NOAA Fish. Bull. 74 (4): 775-781. Oct. 1976. SFA 22(2)
[NMFS, Atl. Estuarine Fish. Cent., Beaufort, NC 28516] Macroscopic examination of gonads and gonad indices demonstrated that March and April were the peak spawning months in Raleigh and Onslow bays, N.C. Ripe fish were collected over irregular bottom from January to April in water ranging from 21 to 100 m in depth. Bottom temperatures during the spawning period ranged from 16.4° to 21.5°C. Three predictors of fecundity, total length, weight, and age were evaluated and regression equations derived. Fish weight proved to be the most precise predictor of fecundity: ln fecundity = 1.7369 + 1.5178 (ln weight of the fish) where fecundity is the total number of eggs in both ovaries. Fecundity estimates ranged from 48,660 for a 304-mm (390-g) red porgy to 488,600 for a 516-mm (1,783-g) fish. Although some individuals reached sexual maturity at age II, most spawn for the first time at age III. Chi-square tests revealed a significant departure from the expected 1:1 sex ratio when data were stratified by month, year, and size. Females were encountered more frequently each month for all 3 yr, and in the smaller size intervals.

76-000575 Moore, J. W. DISTRIBUTION, MOVEMENTS, AND MORTALITY OF ANADROMOUS ARCTIC CHAR, /SALVELINUS ALPINUS/ L., IN THE CUMBERLAND SOUND AREA OF BAFFIN ISLAND. J. Fish Biol. 7 (3): 339-348. May 1975. SFA 22(2)
[Sch. Biol. Sci., Univ. Bath, Bath, Somerset, England] During 1972 the downstream movement of anadromous arctic char, /Salvelinus alpinus/ L., from two rivers flowing into Cumberland Sound, Baffin Island, began during the middle of May and was completed within 2 weeks. This movement took place during both the day and night. Upon reaching saltwater, many char older than 9 years (longer than 20 cm) began to migrate along the shore of the Sound at a rate of 0.6-0.9 km/day with the result that the average maximum distance travelled from the natal river was 40-50 km. Char 6-9 years old, 10-20 cm in length, remained much closer to the rivers while those younger than 5 years never entered saltwater. During the period of saltwater residence, the fish frequently moved into the intertidal zone and freshwater. Maturing fish of both sexes were occasionally found in saltwater. The upstream migration to the lakes began during the second week of August and was completed within 5-6 weeks. Females tended to ascend the rivers before males, although fish of all different size and age migrated upstream simultaneously. Migration occurred during both the day and night. The maximum distance anadromous char moved from saltwater was 40 km. The char were found only in freshwater between May and September and were normally located near the bottom of lakes at a depth of 15-40 m. During this period, large scale movements were probably very limited. Average annual mortality was estimated at 16.0 percent per year with the highest rates (25-30 percent) occurring

76-000575 CONTINUED
at ages 10 and 15-17 years. Many fish probably died of old age but physical deterioration during and after spawning was also an important cause of death.

76-000576 Pietsch, T. W. DIMORPHISM, PARASITISM AND SEX: REPRODUCTIVE STRATEGIES AMONG DEEPSEA CERATIOID ANGLERFISHES. Copeia. 1976 (4): 781-793. 30 Dec. 1976. SFA 22(2)
[Dep. Biol., Calif. State Univ., Long Beach 90840] Knowledge of the reproductive biology of the Ceratiodei is reviewed and new and scattered evidence is brought together in an attempt to reevaluate some previously accepted ideas concerning the unique sexual habits of these fishes. Notes on taxonomic content, available material, occurrence of parasitism, gravid females and ripe males and the ability of males to ingest food independently of the female are given for each ceratioid family, after which this information is summarized and discussed. Data are presented to support at least three reproductive strategies utilized by ceratioid anglerfishes: sexually mature males of the Ceratiidae, Linophrynidae and perhaps the Neoceratiidae, are obligatory sexual parasites; those of the Caulophrynidae and the oneirodid genus /Leptacanthichthys/ are probably facultative sexual parasites; and those of the Melanocetidae, Himantolophidae, Gigantactinidae and at least some oneirodid genera, are non-parasitic and perhaps spawn during a non-parasitic, temporary attachment. The four ceratioid families in which sexual parasitism has been previously recorded appear to form a highly specialized, monophyletic group, most likely derived from some oneirodid-like ancestor. If a facultative sexual parasitism exists for some ceratioids, particularly some oneirodid genera, it would form a convenient evolutionary intermediate between those ceratioids with obligatory sexual parasitism and those whose males never become parasitic.

76-000577 Serra B., J. R. ESCALAS DE MADUREZ SEXUAL PARA SARDINA ESPANOLA (/SARDINOPS SAGAX MUSICA/, GIRARD) Y JUREL (/TRACHURUS SYMMETRICUS MURPHYI/, NICHOLS). [MATURATION SCALES FOR SPANISH SARDINE (/SARDINOPS SAGAX MUSICA/, GIRARD) AND JACK MACKEREL (/TRACHURUS SYMMETRICUS MURPHYI/, NICHOLS).] Inst. Fom. Pesq. Ser. Invest. Pesq. 24. 20p. 1976. In Spanish with English summ. SFA 22(2)
From the observation of the gonads of 135 specimens of spanish sardine (/Sardinops sagax musica/, Girard) and 82 of jack mackerels (Trachurus symmetricus murphyi/, Nichols) a maturation scale for each species was built. Furthermore, the equivalence of these scales with the previously ones in use was also analized.

76-000578 Stasko, A. B. PROGRESS OF MIGRATING ATLANTIC SALMON (/SALMO SALAR/) ALONG AN ESTUARY, OBSERVED BY ULTRASONIC TRACKING. J. Fish Biol. 7 (3): 329-338. May 1975. SFA 22(2)
[Dep. Environ., Fish. Mar. Serv., Biol. Stn., St. Andrews, NB, Canada] adult Atlantic salmon were captured in the Miramichi estuary, tagged with ultrasonic transmitters, and released. Nine fish were tracked for a total of 425 h, spanning 71 flood and ebb tides. There was drifting with the tidal currents, and holding of position relative to land. Fish that achieved overall upstream progress did so by drifting with flood tidal currents and by stemming the ebb currents. Fish which did not achieve upstream progress also drifted with flood tidal currents, but these fish did not stem the ebb currents and dropped back downstream during ebb tides. No differences in movement patterns were apparent for different times of day or wind conditions.

76-000579 Thomson, D. A.; Muench, K. A. INFLUENCE OF TIDES AND WAVES ON THE SPAWNING BEHAVIOR OF THE GULF OF CALIFORNIA GRUNION, /LEURESTHES SARDINA/ (JENKINS AND EVERMANN). Bull. South. Calif. Acad. Sci. 75 (2): 198-203. Aug. 1976. SFA 22(2)

[Dep. Ecol. Evol. Biol., Univ. Ariz., Tuscon 85721] A preliminary analysis of 53 spawning runs of the Gulf grunion, /Leuresthes sardina/ (Jenkins and Evermann) from 1968 to 1973 in the northern Gulf of California suggests that the initiation of a spawning run is strongly dependent on tidal amplitude. Gulf grunion runs occur fortnightly from January to May following a descending series of higher high tides after the new and full moon phases. The runs begin about 3.5 days after the time of full moon and about four days after the new moon. The daytime runs of /L. sardina/ result from a mid-season shift in the time of the higher high spring tides from early morning (0300 to 0500) to late afternoon (1500-1700). The accelerated spawning act of the Gulf grunion appears to be an adaptation to the short period, low amplitude sea waves typical of the protected coasts of the upper Gulf of California rather than increased daytime predation of spawning fish by sea birds.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

76-000580 Alt, K. T. INCONNU, /STENODUS LEUCICHTHYS/, MIGRATION STUDIES IN ALASKA 1961-71. J. Fish. Res. Board Can. 34 (1): 129-133. Jan. 1977. In English with French summ. SFA 22(2)

[Alaska Dep. Fish Game, Div. Sport Fish., Fairbanks 99701] During studies on inconnu, /Stenodus leucichthys/, in the Kobuk, Yukon, Koyukuk, Kuskokwim, Holitna, and Chatanika rivers, and the Selawik and Minto Flats areas, 3907 fish were marked. Nine hundred and ten (23.3 percent) had been recovered by December 31, 1974. Tag return data indicate that tagged inconnu comprise four major populations: Kobuk-Selawik, lower Yukon, Kuskokwim, and Minto Flats. Inconnu undertake rapid downstream postspawning migrations to wintering areas in lower reaches of large rivers (Yukon, Kuskokwim) or slightly brackish inlets (Hotham Inlet, Selawik Lake), then begin slow upstream migration before spring ice breakup, with nonspawning fish travelling to summer feeding areas and spawners migrating to spawning grounds during summer and fall. Minto Flats fish are nonanadromous. Three fish, tagged in the lower Yukon River and recaptured in the Koyukuk River, migrated upstream 1035-1156 km, averaging 13.8 km/day. The longest migration recorded was nearly 1,600 km.

76-000581 Austin, H. M.; Custer, O. SEASONAL MIGRATION OF STRIPED BASS IN LONG ISLAND SOUND. N.Y. Fish Game J. 24 (1): 53-68. Jan. 1977. SFA 22(2)

[NMFS, U.S. Dep. Comm., Washington, DC 20235] Returns from a program of tagging striped bass conducted by the American Littoral Society between 1966 and 1972 are reviewed with particular attention to population movement within Long Island Sound. The data indicate that bass enter the Sound from both ends but chiefly from the east and that there is a stable summer population with the fall migration being one of primary egress through the eastern passages. Most significant is evidence of an intra-Sound fall migration as bass along the entire Connecticut coast appear to migrate to the central part of the Sound, cross to the Long Island shore and then migrate out via the eastern end of the Sound.

76-000582 Ebeling, A. W.; Bray, R. N. DAY VERSUS NIGHT ACTIVITY OF REEF FISHES IN A KELP FOREST OFF SANTA BARABARA, CALIFORNIA. NOAA Fish. Bull. 74 (4): 703-717. Oct. 1976. SFA 22(2)

[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106] Vertical distributions and feeding activities of residential kelp-bed fishes were compared between day and night in an area of reef and kelp off Santa Barbara, Calif. Although almost all of the 25 common fish species recorded were seen both day and night, the number seen and the degree of activity of most of these species decreased considerably at night. Many fishes that fed and moved about in mid-water well above the reef during the day were found in holes and crevices in the reef at night: others that foraged on or just above the bottom during the day showed little change in their position; and still others tended to disperse to adjacent areas of the reef. daytime aggregations of fishes centered around the crest of the reef and other productive prominences and invariably dispersed at night. Unlike tropical communities of reef fishes, the kelp-bed community included neither a broad replacement for diurnal planktivores in the night shift nor a contigent that moves out over nearby sand flats to forage at night. Kelp-bed fishes showed considerable intraspecific variability in behavior. Thus, the kelp-bed community appears to be more loosely "programmed" even though it follows the same basic pattern of diel activity as the tropical-reef community. The kelp-bed species that belong to primarily tropical families tended to be quite specialized in their nocturnal sheltering behavior. Yet the primarily temperate surfperches, for example, simply became somewhat lethargic and remained exposed at night.--From abstr.

76-000583 Kaya, C. M.; Kaeding, L. R.; Burkhalter, D. E. USE OF A COLD-WATER REFUGE BY RAINBOW AND BROWN TROUT IN A GEOTHERMALLY HEATED STREAM. Prog. Fish-Cult. 39 (1): 37-39. Jan. 1977. SFA 22(2)

[Dep. Biol., Mont. State Univ., Bozeman 59715] The Firehole River of Yellowstone National Park receives substantial amounts of geothermally heated water, which raise river temperatures by about 12°C. We have recorded summer temperatures as high as 28.8°C in the lower section of the river. During the warmest part of the summer, rainbow trout (/Salmo gairdneri/) and brown trout (/S. trutta/) from the river concentrate in Sentinel Creek, the only cold-water tributary along the lower Firehole River. These movements into the creek appear to be related to mean daily temperatures exceeding 24°C, or daily maximums exceeding 25°C. Aggregations of fish from cooler waters to heated discharge areas have been extensively documented; however, this contrasting situation of fish from a heated body of water concentrating at a cold-water influent area has been reported only once previously and involved a warm-water species.

76-000584 Manion, P. J. DOWNSTREAM MOVEMENT OF FISH IN A TRIBUTARY OF SOUTHERN LAKE SUPERIOR. Prog. Fish-Cult. 39 (1): 14-16. Jan. 1977. SFA 22(2)

[U.S. FWS, Sea Lamprey Control Stn., Marquette, MI 49855] The influence of two environmental factors, stream flow and water temperature, on the downstream movement of four fish species in the Big Garlic River over a 12-yr period are described. Brook trout (/Salvelinus fontinalis/) migrated after floods had subsided in the spring and during rising water in the fall at temperatures of about 10°C. Brook sticklebacks (/Culaea inconstans/) moved downstream chiefly in winter. Mottled sculpins (/Cottus bairdi/) moved primarily in the winter and during floods. Yellow perch (/Perca flavescens/) appeared to move generally in the fall as water levels increased and water temperatures decreased.

76-000585 Marliave, J. B. A THEORY OF STORM-INDUCED DRIFT DISPERSAL OF THE GASTEROSTEID FISH /AULORHYNCHUS FLAVIDUS/. Copeia. 1976 (4): 794-796. 30 Dec. 1976. SFA 22(2)
[Vancouver Public Aquarium, P.O. Box 3232, Vancouver, BC V6B 3X8, Canada]

76-000586 Solomon, D. J.; Templeton, R. G. MOVEMENTS OF BROWN TROUT /SALMO TRUTTA/ L. IN A CHALK STREAM. J. Fish Biol. 9 (5): 411-423. Nov. 1976. SFA 22(2)
[Salmon Freshwater Fish. Lab., Minist. Agric. Fish. Food, 10 Whitehall Place, London SW1, England] Observations on spawning and movements of trout over 7.5 km of chalkstream indicate five discrete stages of the life history with respect to migrations. (1) Downstream movements from area of hatching to nursery areas, to 6 months of age. (2) Downstream again from the nursery areas to areas of adult growth between 6 months and 15 months of age. (3) A stage of very limited movements by adults between 15 months old and spawning. (4) Upstream spawning migration. (5) Downstream movements following spawning. These movements are similar in principle to those in upland systems though are relatively more local, reflecting the juxtaposition of areas suitable for all stages.

76-000587 Terry, C. B.; Stephens, J. S., Jr. A STUDY OF THE ORIENTATION OF SELECTED EMBIOTOCID FISHES TO DEPTH AND SHIFTING SEASONAL VERTICAL TEMPERATURE GRADIENTS. Bull. South. Calif. Acad. Sci. 75 (2): 170-183. Aug. 1976. SFA 22(2)
[Coll. Fish., Univ. Wash., Seattle 98195] The effects of seasonal temperature variation on the depth distribution of five species of embiotocids in King Harbor, California were studied. Three types of depth distributions were found: /Micrometrus minimus/ was restricted to the intertidal and subtidal margin: /Embiotoca jacksoni/ was most abundant at middle depths and declined in abundance in both shallower and deeper water; /Hypsurus caryi/, /Rhacochilus vacca/, and /Phanerodon furcatus/ formed a deeper water group. The depth distributions of all species except /M. minimus/ shifted into deeper water during late summer and fall and into shallower water during winter and spring. /Micrometrus minimus/ remained in the top 1.5 m throughout the year. Decent into deeper water corresponded to the period of warmest water. Deeper water species selected water colder than 16°C. /Embiotoca jacksoni/ occupied a middle thermal range. The results of this study support an important role for temperature orientation in the spatial organization of this subtidal community.

FOODS AND FEEDING

76-000588 Carr, W. E. S. CHEMORECEPTION AND FEEDING BEHAVIOR IN THE PIGFISH, /ORTHOPRISTIS CHRYSOPTERUS/: CHARACTERIZATION AND IDENTIFICATION OF STIMULATORY SUBSTANCES IN A SHRIMP EXTRACT. Comp. Biochem. Physiol. A Comp. Physiol. 55 (2): 153-157. 1976. SFA 22(2)
[Univ. Fla., Rt. 1, Box 121, St. Augustine 32084] Substances in shrimp extract that stimulate feeding behavior in the pigfish, /Orthopristis chrysopterus/, were characterized and identified. The stimulatory agents had properties consistent with amino acid-like substances as indicated by molecular weights of less than /ca./ 1000 and stability to acid hydrolysis. Quantitative analyses of betaine and the 19 amino acids in shrimp extract were conducted to provide specific concentrations of each substance used for the preparation of artificial mixtures. The stimulatory capacities of these artificial

76-000588 CONTINUED
mixtures were compared with that of the extract. A mixture containing betaine plus the 19 amino acids was fully as stimulatory as the extract itself. Of the substances in the mixture, betaine was individually the most active and could account for /ca./ 39 percent of the potency of the extract.

76-000589 Clady, M.; Hutchinson, B. FOOD OF THE YELLOW PERCH, /PERCA FLAVESCENS/, FOLLOWING A DECLINE OF THE BURROWING MAYFLY, /HEXAGENIA LIMBATA/. Ohio J. Sci. 76 (3): 133-138. May 1976. SFA 22(2)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853] Changes in consumption of benthic invertebrates by yellow perch, /Perca flavescens/, in Oneida Lake during 1958-1973 were similar to changes in the bottom fauna of the lake from 1956 to 1974. The burrowing mayfly, /Hexagenia limbata/, which declined to extinction following severe oxygen depletions, was replaced in the diet by chironomids and amphipods and, to a lesser extent, by isopods and trichopterans. A slight decline in the growth rate of older perch occurred in recent years, which may be related to the disappearance of the mayfly. No obvious change in abundance of perch was evident.

76-000590 Dunn, I. G. ECOLOGICAL NOTES ON THE /HAPLOCHROMIS/ (PISCES: CICHLIDAE) SPECIES-FLOCK OF LAKE GEORGE, UGANDA (EAST AFRICA). J. Fish Biol. 7 (5): 651-666. Sept. 1975. SFA 22(2)
[Aquatic Biol. Consultancy Serv. Ltd., 209 Moulsham St., Chelmsford, Essex CM2 0LG, England] Lake George, a shallow equatorial lake, supports a /Haplochromis/ species-flock of 17 species. Of the five species that dominate the species-flock, two feed mainly on benthic and midwater depteran larvae, one is a piscivore, one exploits microcrustacea and another the abundant blue-green phytoplankton population. There is little stenophagy in this group. There is a seasonal variation in the total gill-net catch of the three dominant /Haplochromis/ of the sandy shoal habitat, with high catches in the wet season and low catches in the dry. Similar fluctuations are known to occur in the commercial catches of /Sarotherodon niloticus/. No seasonal changes were observed in the proportions of the individual species making up this community and the individuals breed all the year round. A combination of ecologically unspecialized species, resulting in an efficient exploitation and stability of the ecosystem may account for the observed high fish biomass and the high numbers of individuals. Taking into account the effect of the monotony of the environmental conditions, the physical continuity of the available habitat types and the relatively short time that the lake has been in existence, coupled with the apparent lack of rigid ecological requirements by the individual members of the /Haplochromis/ group, it is suggested that this species-flock may still be at an early stage in its evolutionary development.

76-000591 Durbin, A. G.; Durbin, E. G. GRAZING RATES OF THE ATLANTIC MENHADEN /BREVOORTIA TYRANNUS/ AS A FUNCTION OF PARTICLE SIZE AND CONCENTRATION. Mar. Biol. 33 (3): 265-277. 5 Dec. 1975. SFA 22(2)
[Grad. Sch. Oceanogr., Univ. R.I., Kingston] The feeding behavior of adult Atlantic menhaden (/Brevoortia tyrannus/) upon 5 species of phytoplankton and 2 species of zooplankton has been studied. Four recognizable feeding stages which were a function of the concentration and size of the food particles were observed. During rapid feeding the fish swam at a constant speed for a prolonged period over a wide range of particle concentrations. Particle and food carbon-concentrations at the threshold for initiation and termination of feeding were inversely

76-000591 CONTINUED
related to particle size. /Carteria chuii/ (13.2 u) was not grazed at a significant rate, while two-cell chains of /Skeletonema costatum/ (16.5 u) were filtered from the water, indicating a minimum-size threshold for filtration of between 13 and 16 u. The most rapid filtering rates were observed for the copepod /Acartia tonsa/ (mean volume swept clear = 24.8 l/fish/min). The maximum food-particle size acceptable to a menhaden appears to be between /Acartia tonsa/ (1200 u) and adult /Artemia salina/ (10 mm). These results suggest that the large schools of menhaden found in Atlantic coastal waters could have a significant effect on the plankton, selectively grazing zooplankton, larger phytoplankton, and the longer chains of chain-forming diatoms.

76-000592 Isaacs, J. D. REPRODUCTIVE PRODUCTS IN MARINE FOOD WEBS. Bull. South. Calif. Acad. Sci. 75 (2): 220-223. Aug. 1976. SFA 22(2)
[Inst. Mar. Resour., Univ. Calif., San Diego 92093] The role of gametes and reproductive products such as sperm, eggs and seeds will be generally discussed as a part of the food flux in terrestrial and marine food webs. Particularly important is the opposed role of reproductive products in these two realms, constituting an "upward" flux (i.e., from the lower developed forms to the more highly developed) on land, and a "downward" flux at sea. In the sea this flux undoubtedly constrains development of higher trophic levels and mature forms. It is an important component of the homogenizing and smoothing processes affecting marine food webs, and the development of a trophic system dominated by immature creatures.

76-000593 Joseph, T. W. POPULATIONS OF INVERTEBRATE ORGANISMS AND THEIR CONSUMPTION BY RAINBOW TROUT (/SALMO GAIRDNERI/ RICHARDSON) AND WALLEYE (/STIZOSTEDION VETREUM/ MITCHILL) IN GRAVEL LAKE, ROLETTE COUNTY, NORTH DAKOTA. Ph. D. dissertation, Univ. N. Dak. 123p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)
Stomach contents of 296 rainbow trout collected during the study indicated that amphipods were fed upon throughout the year. Gastropods were important during the summer and of lesser importance during the winter. The frequency of occurrence of aquatic insects and amphipods in trout stomachs was always high, however the percent total volume of insects was sometimes insignificant. Minnows occurred more often and in greater quantities in the stomachs of larger trout than in smaller trout. The stomach contents of 388 walleye taken during the study indicated that they fed largely on minnows. They also took frogs when available and fed on amphipods during a limited period in the year. It was concluded that there was little competition or predation between the rainbow trout and walleye in this lake.--From abstr.

76-000594 Kravitz, M. J.; Pearcy, W. G.; Guin, M. P. FOOD OF FIVE SPECIES OF COOCCURRING FLATFISHES ON OREGON'S CONTINENTAL SHELF. NOAA Fish. Bull. 74 (4): 984-990. Oct. 1976. SFA 22(2)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331]

76-000595 Lanchester, B. S.; Mark, R. F. PURSUIT AND PREDICTION IN THE TRACKING OF MOVING FOOD BY A TELEOST FISH (/ACANTHALUTERES SPILOMELANURUS/). J. Exp. Biol. 63 (3): 627-645. Dec. 1975. SFA 22(2)
[Dep. Physiol., Monash Univ., Melbourne, Australia]

76-000596 Li, H. W.; Moyle, P. B. FEEDING ECOLOGY OF THE PIT SCULPIN, /COTTUS PITENSIS/, IN ASH CREEK, CALIFORNIA. Bull. South. Calif. Acad. Sci. 75 (2): 111-118. Aug. 1976. SFA 22(2)

[Div. Wildl. Fish Biol., Univ. Calif., Davis 95616] The diet of the Pit sculpin, /Cottus pitensis/, consists mainly of benthic invertebrates and is similar to the diet of other stream-dwelling members of the genus /Cottus/. They feed at all hours but show a peak of feeding intensity in the early morning. Electivity indices indicate that they are highly selective in their feeding but that the reasons they select particular organisms are complex. They appear to be ecologically segregated from the three species that commonly occur with them, speckled dace (/Rhinichthys osculus/), Sacramento sucker (/Catostomus occidentalis/), and rainbow trout (/Salmo gairdneri/).

76-000597 Major, P. F. STUDIES OF PREDATOR-PREY INTERACTIONS IN SCHOOLING FISH. Ph. D. dissertation, Univ. Calif. (Santa Cruz) 205p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

Experimental and field studies are conducted to explore the adaptiveness and relative effectiveness of the schooling habit for predatory as well as prey fish species. In addition, other adaptations of the species studied making survival possible in particular environments were investigated.--From abstr.

76-000598 Minckley, C. O.; Deacon, J. E. FOODS OF THE DEVIL'S HOLE PUPFISH, /CYPRINODON DIABOLIS/ (CYPRINODONTIDAE). Southwest. Nat. 20 (1): 105-111. 15 May 1975. SFA 22(2)

[Dep. Biol., North Ariz. Univ,. Flagstaff 86001] Food habits of the unique Devels Hole pupfish, /Cyprinodon diabolis/ Wales, which until recently established in refugia was known only from Devils Hole, a limnocrene in Nye County, Nevada, were studied from data collected during a 14-month period. A general pattern of opportunism in feeding and responses to variations in food supplies was indicated. Inorganic particulate matter remained highest in volume, frequency of occurrence, and numerically throughout the period. The green alga, /Spirogyra/, and various diatoms were about equal in occurrence, but varied seasonally in a reciprocal manner with diatoms being most important in winter and spring. The amphipod, /Hyalella/, was present more frequently than either an unidentified ostracod or protozoans which were found at about the same frequency. Other endemic organisms found in small numbers were the elmid beetle, /Stenelmis/, a turbellarian, /Dugesia/, and a hydrobiid snail, /Tryonia/. Six of the 66 available stomachs were empty.

76-000599 Moore, J. W.; Moore, I. A. THE BASIS OF FOOD SELECTION IN SOME ESTUARINE FISHES. EELS, /ANGUILLA ANGUILLA/ (L.), WHITING, /MERLANGIUS MERLANGUS/ (L.), SPRAT, /SPRATTUS SPRATTUS/ (L.) AND STICKLEBACK, /GASTEROSTEUS ACULEATUS/ L. J. Fish Biol. 9 (5): 375-390. Nov. 1976. SFA 22(2)

[Environ. Can., P.O. Box 2310, Yellowknife, NT X0E 1H0, Canada] Non-migratory (yellow) eels measuring from 19.5-56.5 cm in length fed mainly on either the decapod /Crangon vulgaris/ or on the mysid /Neomysis integer/ during the warmer months but ceased to feed in the winter. Whiting measuring between 2.5 and 15 cm fed almost exclusively on /C. vulgaris/, /N. integer/ and the sand goby, /Pomatoschistus minutus/. Sprats fed chiefly on either the amphipod /Gammarus salinus/ or /N. integer/. Sticklebacks seldom contained any food in their stomachs despite the presence of large quantities of suitable prey and the high level of hunting efficiency. /Gammarus salinus/, although normally abundant in the environment, was usually ingested in disproportionately small quantities by all fishes except sprats

76-000599 CONTINUED
reflecting its concealment among floating weeds and a selection against small (less than 1 cm) organisms. Because of the limitations of size and the unusually efficient escape reaction of larger animals, only young representatives of /Crangon vulgaris/ were captured. The isopod /Eurydice pulchra/ was rarely eaten by any of the fishes even though it was common in the environment. Burrowing polychaetes, mainly /Nereis diversicolor/, were never utilized possibly due to the difficulty involved in removing these organisms from the substrate. /Neomysis integer/ was the most frequently consumed organism. Although the average length of prey ingested by the whitings increased with the size of fish, this was not the case for the other species. The proporiton of non-feeding eels and the dry weight of stomach contents of this species depended on the temperature of the water but were not related to the availability of prey and tidal conditions whereas the feeding of whiting could not be related to any environmental parameter.--From abstr.

76-000600 Moore, J. W.; Moore, I. A. THE BASIS OF FOOD SELECTION IN FLOUNDERS, /PLATICHTHYS FLESUS/ (L.), IN THE SEVERN ESTUARY. J. Fish Biol. 9 (2): 139-156. Aug. 1976. SFA 22(2)
[Environ. Can., P.O. Box 2310, Yellowknife, NWT X0E 1H0, Canada]
Flounders measuring between 6.0 and 35 cm fed heavily on the polychaete /Nereis diversicolor/ in February and on the amphipod /Gammarus salinus/ between February and April. Thereafter these species were replaced by the mysid /Neomysis integer/ with the decapod /Crongon vulgaris/. Flounders shorter than 6.0 cm, fed mainly on /Neomysis integer/ regardless of month. Numerous factors were involved in the choice of the food including (1) the maximum and minimum length of prey, (2) its spatial distribution in the water column, (3) its degree of concealment, (4) its motility and ability to escape predation, (5) conditioning of the flounders for certain foods, (6) the fish's swimming speed and (7) the turbidity and temperature of the water. Although the average length of ingested prey remained unchanged as the fish grew in size, an increase in the maximum and minimum lengths was observed. The percentage of stomachs that contained no identifiable remains in flounders greater than 6.0 cm averaged 80-95 percent during part of the winter and 60 percent in the summer and between January and March. These changes partly reflected the influence of low water temperature on the metabolic rate and availability of prey. The dry weight of the stomach contents in flounders longer than 6.0 cm was lowest in winter but high values were recorded in the spring. This latter feature was probably because the rate of feeding was greater than that of digestion. During the summer, under more normal feeding conditions, the weight of the stomach contents remained relatively low compared to other fish populations. Flounders shorter than 6.0 cm always contained more food in their stomachs on a unit weight basis than larger individuals, reflecting metabolic rate and hunting efficiency.--From abstr.

76-000601 Pemberton, R. SEA TROUT IN NORTH ARGYLL SEA LOCHS: II. DIET. J. Fish Biol. 9 (3): 195-208. Sept. 1976. SFA 22(2)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland]
The diet of sea trout in some of the sea lochs of the west coast of Scotland was investigated. The contents of 986 sea trout stomachs from the Loch Etive area (1970-1973), and 291 stomachs from the Loch Eil area (1964-1973), were examined and the composition of the diet, seasonal changes and the effect of trout size were analysed using frequency of occurrence, dry weight and number of organisms methods. Benthic feeding (crustacea and annelids) was more important in winter while midwater and surface organisms (young fish and insects) were preferred in summer. Young fish (mainly clupeids and sand eels)

76-000601 CONTINUED
featured more in the diet of larger trout (≥ 21 cm) than in the smaller size range (≤ 21 cm). Surveys of 24-h were completed in June and September, 1972, and indicated that availability of food was the main factor influencing the presence or absence of trout. Bottom feeding was greatest during the day while the amount of midwater and surface feeding tended to increase between sunset and sunrise.

76-000602 Plantz, D. V., Jr. SIZE-SELECTIVE PREDATION BY /POECILIOPSIS OCCIDENTALIS/ (BAIRD AND GIRARD). Ph. D. dissertation, Ariz. State Univ. 93p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(4), 1976. SFA 22(2)

Gila topminnows feed in Monkey Spring on a variety of food items, but the amphipod /Hyalella azteca/, (Saussure) is an important element of the invertebrate diet of mature females. The males and juveniles are primarily detritivores. The size of the amphipods ingested by female topminnows is a function of the size of the fish, with larger fish taking larger prey. There is also a tendency for topminnows to select large amphipods from within the size limits imposed by the width of the mouth. The correlation between fish size and prey size was also seen in laboratory experiments, whether /Daphnia similis claus/ or pelletized fish food was used as prey. A feeding period in the laboratory is characterized by two distinct phases. During the first phase, feeding is rapid and nonselective. As feeding progresses, the rate of feeding drops dramatically and selectivity increases. Given a choice between two alternative prey of widely divergent sizes, topminnows feed preferentially on the larger prey if both sizes are present in equal numbers and prey densities fall within certain limits. At both high and low extremes of prey concentration, selectivity for large prey disappears. When prey are present at intermediate densities and unequal numbers, topminnows tend to prey upon the food item presented in the greatest abundance. Competition among topminnows of different sizes influences both the rate of feeding and the degree of selectivity exhibited towards large prey. Differential reaction distances to prey of different sizes may form an integral component of the mechanism underlying feeding biased towards large prey items in topminnows. The effects of perceptual limitations should be distinguished before comparing empirical data on size-biased feeding with the predictions of optimal foraging strategies.--From abstr.

76-000603 Rhodes, R. J.; McComish, T. S. OBSERVATIONS ON THE ADULT ALEWIFE'S FOOD HABITS (PISCES: CLUPEIDAE: /ALOSA PSEUDOHARENGUS/) IN INDIANA'S WATERS OF LAKE MICHIGAN IN 1970. Ohio J. Sci. 75 (1): 50-55. Jan. 1975.

Adult alewives, /Alosa pseudoharengus/ (Wilson) collected from June to October 1970, at a 10-m deep station in Lake Michigan near Michigan City, were examined for stomach contents. Zooplankton (cladocerans and copepods) comprised the largest volume of stomach contents in two alewife size groups (140-169 mm and 170-180 mm) in all months except June. In June larval aquatic insects (chironomids) comprised the highest volume of identifiable food items. Only a slight difference in the average percent volume and presence of food items occurred when comparing the two groups. In pooled samples of alewives (149-189 mm), the percent occurrence and volume of cladocerans in stomachs generally increased from June to October. Maximum copepod percent volume occurred in July followed by a decline to least percent volume in October. /Pontoporeia affinis/ was an abundant October food item, and immature chironomids attained maximums in June.

76-000604 Smith, A. O. SOME ASPECTS OF TROPHIC RELATIONS OF GIZZARD SHAD, /DOROSOMA CEPEDIANUM/. Ph. D. dissertation, Va. Polytech. Inst. & State Univ. 98p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

Foods, feeding, voidance, and bioenergetics of gizzard shad were investigated. Ten of the 17 most frequently occurring plankters in Smith Mountain Reservoir were utilized as food: the bulk of the diet consisted of /Blenodinium/, /Dinobryon/, and copepod nauplii. The feeding behavior of shad was described. Shad were observed to demonstrate the directed activity of seeking particulate materials from the substratum. It was concluded that shad are continuous feeders, but show seasonal variation in food intake. Evacuation of the alimentary tract required 18 to 21 hours and was related to continuous feeding activity. Feeding trials with /Artemia/ nauplii yielded the equation: n/T = 1.36 T to the 0.23 W to the 0.46 D to the 0.09. Filtration rates were shown to be inversely related to feeding duration and body size. Oxygen consumption was measured at three temperatures. Routine metabolism-weight relations were shown to be M = 0.452 W to the 0.848 at 10 C, M = 0.659 W to the 0.841 at 15 C and M = 0.769 W to the 0.937 at 20 C in a siphon-equiped respirometer. At 20 C this relationship was M = 0.627 W to the 0.813 in a flowing water system. A typical yearling gizzard shad, 34 g in weight, required a dietary equivalent of 1204 cal/day of which 905 cal were spent for respiratory metabolism.

76-000605 Stein, R. A.; Kitchell, J. F.; Knezevic, B. SELECTIVE PREDATION BY CARP (/CYPRINUS CARPIO/ L.) ON BENTHIC MOLLUSCS IN SKADAR LAKE, YUGOSLAVIA. J. Fish Biol. 7 (3): 391-399. May 1975. SFA 22(2)

[Lab. Limnol., Univ. Wis., Madison 53706] Analysis of predation by carp (/Cyprinus carpio/ L.) on mollusc species in Skadar Lake, Yugoslavia, indicated both generalized and specific features of a predator-prey interaction. Vertical distribution of molluscs in sediments seemed unrelated to predation rates by carp. Although size selective predation may occur, electivity indices appeared most related to shell shape and thickness. Of the three most abundant species, Electivity was high for /Valvata piscinalis/ but low for /Pyrgula annulata/ and /Dreissencia polymorpha/. /Valvata/ has a more readily crushed shell, a higher proportion of occupied shells and a greater percentage of organic content than /Pyrgula/. Although a potentially preferred prey item, /Dreissencia/ probably escaped intensive predation by being attached to larger objects. Carp appeared to utilize a sequence of tactile and gustatory cues in the prey selection process.

76-000606 Tyler, H. R., Jr.; Pearcy, W. G. THE FEEDING HABITS OF THREE SPECIES OF LANTERNFISHES (FAMILY MYCTOPHIDAE) OFF OREGON, USA. Mar. Biol. 32 (1): 7-11. 22 Sept. 1975. SFA 22(2)

[Sch. Oceanogr., Oreg. State Univ., Corvallis] The common myctophids /Stenobrachius leucopsarus/, /Diaphus theta/ and /Tarletonbeania crenularis/ were found to feed primarily on the euphausiid /Euphausia pacifica/, the copepods /Metridia lucens/ and /Calanus/ spp., and the amphipod /Parathemisto pacifica/. The diets of these species of fishes were diverse and overlapped broadly, suggesting that they are feeding generalists. Most stomachs contained either all copepods or all euphausiids. Euphausiids were the most important prey on the basis of biomass. They comprised over one-half the weight of the stomach contents in over 40 percent of individuals of each of the three fishes. Stomach fullness and state of digestion of stomach contents differed over the diel period, but not enough to indicate feeding only during the nighttime. Average stomach fullness was greatest during the morning and night and well-digested material,

76-000606 CONTINUED
which predominated in most stomachs, was most prevalent in the morning and afternoon. Either some feeding occurs throughout the day or digestion rates are slow.

76-000607 Wolfert, D. R.; Busch, W.-D. N.; Baker, C. T. PREDATION BY FISH ON WALLEYE EGGS ON A SPAWNING REEF IN WESTERN LAKE ERIE, 1969-71. Ohio J. Sci. 75 (3): 118-125. May 1975. SFA 22(2)
[U.S. FWS, Sandusky Biol. Stn., Sandusky, OH 44870] Nearly 2,000 fish representing 21 species were captured with experimental gillnets on Kelleys Island Shoal during the spawning and incubation periods of walleyes (/Stizostedion v. vitreum/) in 1969-71. A total of 794 stomachs were examined. Four species contained walleye eggs: yellow perch (/Perca flavescens/), spottail shiner (/Notropis hudsonius/), stonecat (/Noturus flavus/) and white sucker (/Catostomus commersoni/). Yellow perch were by far the most consistent predators of walleye eggs, and spent female perch consumed more eggs than did males. The average number of walleye eggs in perch stomachs collected on any one day ranged from 36 to 734 for females and from 4 to 237 for males. The loss of walleye eggs due to fish predation appeared to be significant only when the rate of water warming slowed or stopped, thereby creating an extended overlap in the walleye-yellow perch reproductive period. Only under the uncommon condition of an extended time interval between walleye hatching and perch spawning, coupled with the presence of a large quantity of actively feeding perch, could egg predation reduce walleye reproductive success.

76-000608 Wrzesinski, O. RELATION BETWEEN /ENGRAULIS ANCHOITA/ CONCENTRATIONS AND PRESENCE OF /MERLUCCIUS HUBBSI/ ON THE PATAGONIAN CONTINENTAL SHELF. Mar. Biol. 32 (1): 13-17. 22 Sept. 1975. SFA 22(2)
[Morski Inst. Rybacki, Gdynia, Poland] During the second cruise of the R.V. "Professor Siedlecki" in spring and summer, 1973, concentrations of anchovy and hake were reported in the area off Golfo Nuevo and the Bay of San Mathias, Argentina. Observations were mainly made with the help of acoustic equipment. The echo recordings revealed an interrelationship between the presence of anchovy schools and the appearance of hake concentrations. This paper demonstrates that this relation is trophic in character.

AGE AND GROWTH

76-000609 Bannister, J. V. THE LENGTH-WEIGHT RELATIONSHIP, CONDITION FACTOR AND GUT CONTENTS OF THE DOLPHIN-FISH /CORYPHAENA HIPPURUS/ (L.) IN THE MEDITERRANEAN. J. Fish Biol. 9 (4): 335-338. Oct. 1976. SFA 22(2)
[Dep. Physiol. Biochem., Royal Univ. Malta, Msida, Malta] The length-weight relationship and condition factor of 420 dolphin-fish (/Coryphaena hippurus/) collected in Malta in 1974 were determined. The length-weight relationship for the size range investigated was similar to that reported for the fish from North America. The main food items were flying fish and other fish and crabs.

76-000610 Briggs, P. T. AN UNUSUALLY LARGE STRIPED SEAROBIN FROM LONG ISLAND SOUND, NEW YORK. N.Y. Fish Game J. 24 (1): 96-97. Jan. 1977. SFA 22(2)
[N.Y. State Dep. Environ, Conserv., Albany 122011

76-000611 Crisp, D. T.; Carrick, S. M. SOME OBSERVATIONS ON THE GROWTH AND LENGTH:WEIGHT RELATIONSHIP OF THE SOUTH GEORGIA COD /NOTOTHENIA ROSSII MARMORATA/ FISCHER DURING THE FIRST FOUR YEARS OF LIFE. J. Fish Biol. 7 (3): 407-409. May 1975. SFA 22(2)
[Freshwater Biol. Assoc., The ferry House, Far Sawrey, Ambleside, Westmorland, England] The paper describes the length:weight relationship and the results of back-calculating fish length from scale length for /Notothenia rossii marmorata/ Fischer, collected in April 1961 from Leith Harbour, South Georgia.

76-000612 Hulata, G.; Moav, R.; Wohlfarth, G. THE EFFECTS OF MATERNAL AGE, RELATIVE HATCHING TIME AND DENSITY OF STOCKING ON GROWTH RATE OF FRY IN THE EUROPEAN AND CHINESE RACES OF THE COMMON CARP. J. Fish Biol. 9 (6): 499-513. Dec. 1976. SFA 22(2)
[Agric. Res. Organ., Fish Aquacult. Res Stn., Dor, Israel] The effects of genetic and environmental factors (maternal age, relative hatching time and density) and their interactions on the growth rate of carp fry were evaluated. It was confirmed that relative size of fry immediately after hatching is a major determinant of further growth rate, but that the cause of the initial advantage (hereditary or environmental) is of little importance. A theoretical model was developed to express the quantitative relationships between the interacting genetic and environmental factors.

76-000613 Hunt, P. C.; Jones, J. W. A POPULATION STUDY OF /BARBUS BARBUS/ L. IN THE RIVER SEVERN, ENGLAND. III. GROWTH. J. Fish Biol. 7 (3): 361-376. May 1975. SFA 22(2)
[Fish. Res. Div., Minist. Agric. Fish., P.O. Ngapuna, Rotorua, New Zealand] Scales from 7071 barbel from the River Severn were used for age and growth determinations. The scales showed clear annual checks which were laid in May when most fish spawned. Scale structure and length frequency distributions showed an almost total absence of 1968 year class barbel. Growth was significantly faster in some sections of the sampling area than in others. Back-calculated growth analysis showed a systematic decrease in length for each age for females and males in the 1961 to 1967 year classes. Females grew significantly faster than males after four years of age and reached greater ultimate size. There was a preponderance of males between the ages of III and VII and a dominance of females in older age groups. The overall sex ratio of males to females was 2.41:1. A distinct seasonal growth pattern was shown.

76-000614 Jones, B. C.; Geen, G. H. AGE DETERMINATION OF AN ELASMOBRANCH (/SQUALUS ACANTHIAS/) BY X-RAY SPECTROMETRY. J. Fish. Res. Board Can. 34 (1): 44-48. Jan. 1977. In English with French summ. SFA 22(2)
[Dep Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada] Ages of spiny dogfish (/Squalus acanthias/) in the Strait of Georgia, B.C., have been estimated by an X-ray spectrometric technique which involves measuring variations in the element composition within vertebrae.

76-000615 Laurence, G. C. LABORATORY GROWTH AND METABOLISM OF THE WINTER FLOUNDER /PSEUDOPLEURONECTES AMERICANUS/ FROM HATCHING THROUGH METAMORPHOSIS AT THREE TEMPERATURES. Mar. Biol. 32 (3): 223-229. 15 Oct. 1975. SFA 22(2)

[NMFS, Northeast Fish. Cent., Narragansett, RI] Growth and metabolism of the winter flounder /Pseudopleuronectes americanus/ were studied in the laboratory at 2°, 5° and 8°C. Dry-weight determinations of growth demonstrated significant direct regressions of growth on temperature. Mean, daily specific growth rates were 10.1 percent/day at 8°C, 5.8 percent/day at 5°C, and 2.6 percent/day at 2°C. Time to metamorphosis was 49 days at 8°C and 80 days at 5°C. Larvae did not survive to metamorphosis at 2°C. Absolute values of routine metabolism expressed in ul of oxygen consumed regressed on body weight were best described by a third-degree polynomial. Larval routine metabolism increased from hatching to metamorphosis, at which time it declined before again increasing. Temperature directly affected routine metabolism. Metabolism on a unit-weight basis decreased with increasing size and was also directly influenced by temperature.

76-000616 Payne, A. I. THE DETERMINATION OF AGE AND GROWTH FROM THE SCALES IN /BARBUS LIBERIENSIS/ (PISCES, CYPRINIDAE). J. Zool. (Lond.) 180 (4): 455-465. Dec. 1976. SFA 22(2)

[Dep. Biol. Stud., Lanchester Polytech., Coventry, England] The predictability of scale check formation in /Barbus liberiensis/ has been investigated. Scale length is shown to be linearly related to body length. The formation of the check can be interpreted in terms of the reproductive cycle and changes in somatic condition. Throughout the population check formation takes place in two phases, resorption of material from the scale edges coinciding with the early and middle phases of gonad maturation, and the formation of the check itself as a result of repair as maturation is completed. Check formation is not correlated with actual spawning activity and fluctuations in food intake and temperature are insignificant. Mean body lengths at the end of the first, second and third years were 6.9 cm, 8.3 cm and 9.3 cm. There was no significant difference in the growth rate of males and females although the females tend to live longer and therefore attain a greater maximum size. Some individuals may not have formed a check at the end of the first year. The difference between check formation in tropical and temperate fish and also between forest and savanna types are discussed. The predictability and factors affecting check formation in tropical freshwater fish are considered.--From abstr.

76-000617 Ralston, S. AGE DETERMINATION OF A TROPICAL REEF BUTTERFLYFISH UTILIZING DAILY GROWTH RINGS OF OTOLITHS. NOAA Fish. Bull. 74 (4): 990-994. Oct. 1976. SFA 22(2)

[Coll. Fish., Univ. Wash., Seattle 98195]

76-000618 Tweddle, D. AGE AND GROWTH OF THE CATFISH /BAGRUS MERIDIONALIS/ GUNTHER IN SOUTHERN LAKE MALAWI. J. Fish Biol. 7 (5): 677-685. Sept. 1975. SFA 22(2)

[U.N.D.P./F.A.O. Fish., Monkey Bay, Malawi] Vertebrae from 250 /Bagrus meridionalis/ from the southern end of Lake Malawi were used for age and growth determinations. There is a close correlation between ages determined from length frequency data and ages obtained by back-calculation of the lengths when vertebral rings are laid down. The rings are laid down annually, probably during the breeding season. Females grow slightly faster than males, the difference being in the order of 1-2 cm/year in the early stages. Recruitment to the trawl fishery takes place in the third year of life. Both sexes breed for the first time at the end of their fourth year. There is a much

76-000618 CONTINUED
greater mortality in the male population after 40 cm in length.

76-000619 Weber, J. J. WINTER OBSERVATIONS ON THE AGE AND GROWTH OF THE BURBOT IN LAKE WINNEBAGO, WISCONSIN. Wis. Dep. Nat. Resour. Res. Rep. 89. 10p. Oct. 1976. SFA 22(2)

[Wis. Dep. Nat. Resour., Madison] Age and growth characteristics of the burbot, /Lota lota/ (Linnaeus), in Lake Winnebago were described from a collection of 951 fish taken in fyke nets set under the ice during winter netting operations from 1969 through 1971. Age determinations were made from counts of the opaque zones on otoliths for 308 fish. Resolution of otolith zones, particularly with older individuals, was enhanced by staining otoliths in a concentrated solution of fluorescein dye. Otolith margins were opaque and considered incomplete during the February collection period, and the degree of opaqueness varied with age. The average growth in length of burbot from Lake Winnebago was below that reported for burbot from large lakes in North america. The hypothesis that relatively high summer water temperatures in this shallow, eutrophic lake may exert an influence on differential seasonal growth would require more definitive work during the entire year. All males were mature at age-group III; all females were mature at age-group IV. The length-weight relationship for the population was described as log W = -5.3436 + 3.1031 log L where W = weight in grams and L = total length in millimeters.

76-000620 Woolland, J. V.; Jones, J. W. STUDIES ON GRAYLING, /THYMALLUS THYMALLUS/ L., IN LLYN TEGID AND THE UPPER RIVER DEE, NORTH WALES. I. AGE AND GROWTH. J. Fish Biol. 7 (6): 749-773. Nov. 1975. SFA 22(2)

[Fish. Res. Div., Minist. Agric. Fish., Christchurch, New Zealand] Scale and length/weight data from 2071 Llyn Tegid grayling and 1803 River Dee grayling were used for age and growth determinations. The time of scale annulus formation varied from autumn in some years to spring in other years. Seasonal changes in length, weight and the condition factor were described. The main growth period was from spring to autumn with very little growth occurring during the winter. Annual growth in length was back-calculated from scale measurements, and von Bertalanffy's model was fitted to the resulting length for age data. Comparisons were made between the specific growth rates and ultimate lengths of Llyn Tegid and River Dee grayling, and between the growth of male and female grayling. Males grew faster than females after the onset of sexual maturity. Calculated lengths were converted to weights using a combined length/weight relationship for Llyn Tegid and River Dee grayling. Changes were evident in this relationship throughout the life of the fish.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

76-000621 Ahlstrom, E. H.; Moser, H. G.; O'Toole, M. J. DEVELOPMENT AND DISTRIBUTION OF LARVAE AND EARLY JUVENILES OF THE COMMERCIAL LANTERNFISH, /LAMPANYCTODES HECTORIS/ (GUNTHER), OFF THE WEST COAST OF SOUTHERN AFRICA WITH A DISCUSSION OF PHYLOGENETIC RELATIONSHIPS OF THE GENUS. Bull. South. Calif. Acad. Sci. 75 (2): 138-152. Aug. 1976. SFA 22(2)

[NMFS, Southwest Fish. Cent., La Jolla, CA 92038] /Lampanyctodes hectoris/ is a species of lanternfish which is becoming an important part of the pelagic fishery off South Africa. The Southwest Africa Pelagic Egg and Larval Survey has provided an abundance of larval

76-000621 CONTINUED
specimens of this species. The larvae, transitional and early juvenile stages are described and illustrated for the first time and information on their distribution and relative abundance is provided. Larval characters are used in combination with selected adult characters to elucidate the phylogenetic affinities of this genus.

76-000622 Anderson, W. D., Jr.; Dias, J. K.; Dias, R. K.; Cupka, D. M.; Chamberlain, N. A. THE MACROFAUNA OF THE SURF ZONE OFF FOLLY BEACH, SOUTH CAROLINA. NOAA Tech. Rep. NMFS SSRF-704. iv + 23p. Jan. 1977. SFA 22(2)
[Grice Mar. Biol. Lab., 205 Fort Johnson, Charleston, SC 26442] A seining survey of the macrofauna of the surf zone at Folly Beach, Charleston County, S.C., was conducted from October 1969 to October 1971. Eighty-seven collections were made in the surf and associated tidal pool resulting in the capture of 512 specimens of swimming invertebrates representing at least 17 species and 5,095 specimens of bony fishes representing 41 species. The data obtained are analyzed on seasonal and yearly bases for total weights and numbers of species and specimens. Species are ranked as to importance; and prediction equations for monthly average number of specimens per collection in the surf, based on environmental variables, are developed. Length-frequency data and other aspects of the biology of selected species are presented. Length-length and length-weight relationships are given for certain species. Recommendations for the improvement of the methodology for similar surveys are made.

76-000623 Blackburn, M.; Nellen, W. DISTRIBUTION AND ECOLOGY OF PELAGIC FISHES STUDIED FROM EGGS AND LARVAE IN AN UPWELLING AREA OFF SPANISH SAHARA. NOAA Fish. Bull. 74 (4)d 885-896. Oct. 1976. SFA 22(2)
[Inst. Mar. Resour., Univ. Calif., La Jolla 92093] Fish eggs and larvae were taken in vertical zooplankton hauls in a small upwelling area off Spanish Sahara. Series of hauls were made repetitively from March to May 1974, sometimes with accompanying hydrocasts. About 58 percent of the eggs and 72 percent of the larvae belonged to the following pelagic species: /Sardina pilchardus/, /Engraulis encrasicholus/, /Trachurus/ spp., and /Maurolicus/ sp. Is was estimated from contemporaneous current meter data and other information that the eggs of those species were spawned very close in time and space to where they were collected. Thus adult /Sardina/ and /Engraulis/ appeared to occur typically on the continental shelf, adult /Trachurus/ at the edge of the shelf, and adult /Maurolicus/ over the continental slope. These distributions were verified for /Sardina/ and /Trachurus/ from fishing results of Polish vessels. Acoustically detected concentrations of fish were identified by species according to those results. The area of abundance of /Sardina/ was characterized by maxima of phytoplankton and small zooplankton. Abundance of /Sardina/ eggs changed with time, Because of variations in the size of the adult population in the area (acoustically estimated) and in its production of eggs. The major change in population size coincided with a similar change in the amount of food, Especially phytoplankton, available. Variations in egg production may have been associated with the mean temperature in the water column, since eggs were scarce when the mean was below 16.5°C even when adults were abundant.

76-000624 Guillory, V., Sr. APPARENT ABSENCE OF /PERCINA NIGROFASCIATA/ FROM THE MISSISSIPPI VALLEY. Copeia. 1976 (4): 804-805. 30 Dec. 1976. SFA 22(2)
[Fla. Game Fresh Water Fish Comm., 5950 W. Colonial Dr., Orlando 32808]

76-000625 Hargreaves, P. M. SOME OBSERVATIONS ON THE RELATIVE ABUNDANCE OF BIOLOGICAL SOUND SCATTERERS IN THE NORTH-EASTERN ATLANTIC OCEAN, WITH PARTICULAR REFERENCE TO APPARENT FISH SHOALS. Mar. Biol. 29 (1): 71-87. 21 Feb. 1975. SFA 22(2)
[Inst. Oceanogr. Sci., Warmley, Surrey, England] In various months of the years between 1960 and 1972 a number of echo-surveys were done in the the North-eastern Atlantic Ocean between Latitudes 12° and 62°N, and from the European and African coasts to a longitude of approximately 29°W. Small and moderate-sized shoals were found to be very numerous in spring and summer in oceanic water to the West and North-west of the British Isles. Large numbers of shoals of various sizes were also observed at various time of the year in the Bay of Biscay and near certain parts of the European and African Continental Shelf, near certain seamounts, and near islands such as the Azores, Madeira, and the Cape Verde Islands. In general, shoals appeared to be relatively sparse in the more southerly temperate and subtropical regions of the open ocean. The depth distribution of shoals in open water varied greatly but, on average, the maximum daytime depth of those in the more southerly area of the survey was slightly greater than that of those in the more northerly area. Shoal size also varied, shoals to the north of Latitude 50°N were on average slightly smaller than those detected in southerly regions. Possible identification of the fish is discussed.--From abstr.

76-000626 Harp, G. L.; Matthews, W. J. FIRST ARKANSAS RECORDS OF /LAMPETRA SPP./ (PETROMYZONTIDAE). Southwest. Nat. 20 (3): 414-416. 10 Oct. 1975. SFA 22(2)
[Div. Biol. Sci., Ark. State Univ., State University 72467]

76-000627 Hogg, R. G. ECOLOGY OF FISHES OF THE FAMILY CICHLIDAE INTRODUCED INTO THE FRESH WATERS OF DADE COUNTY, FLORIDA. Ph. D. dissertation, Univ. Miami 155p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

76-000628 Holden, P. B.; Stalnaker, C. B. DISTRIBUTION OF FISHES IN THE DOLORES AND YAMPA RIVER SYSTEMS OF THE UPPER COLORADO BASIN. Southwest. Nat. 19 (4): 403-412. 20 Jan. 1975. SFA 22(2)
[Utah Coop. Fish Res. Unit, Utah State Univ., Logan 84322] Fish sampling was conducted in the Dolores River, Colorado, in 1971 and the Yampa River system of Colorado, 1968-71 with emphasis placed on rare and endangered species. Eleven species were found in the Dolores River, but no rare and endangered forms were collected. Twenty-two species were collected in the Yampa River system, including four rare and endangered forms: Colorado squawfish (/Ptychocheilus lucius/), humpback chub (/Gila cypha/), bonytail chub (/Gila elegans/) and humpback sucker (/Xyrauchen texanus/). The Yampa system appeared important to reproduction and preservation of Colorado squawfish.

76-000629 Horn, M. H.; Allen, L. G. NUMBERS OF SPECIES AND FAUNAL RESEMBLANCE OF MARINE FISHES IN CALIFORNIA BAYS AND ESTUARIES. Bull. South. Calif. Acad. Sci. 75 (2): 159-170. Aug. 1976. SFA 22(2)
[Dep. Biol., Calif. State Univ., Fullerton 92634] Fish species numbers and surface area of 13 California bays and estuaries and the California continental shelf were positively correlated, and the slope (z) of the log-log regression was 0.21. Mouth width of bays was the only significant variable accounting for variation of species numbers in stepwise multiple regression. Clustering based on presence or absence of fish species produced a southern and a northern group of bays. A two-way table (bay vs. species) distinguished three broad distributional categories of fish species. Comparisons of area and species numbers of Chesapeake Bay and King Harbor (southern California) with those of California bays and estuaries supported the view that the present study has relevance for the preservation and management of bay/estuarine systems.

76-000630 Pequeno R., G. THE NOMEID FISH /CUBICEPS CAPENSIS/ IN THE SOUTH PACIFIC OCEAN. Copeia. 1976 (4): 805-807. 30 Dec. 1976. SFA 22(2)
[Inst. Zool., Univ. Austral Chile, Castilla 567, Valdivia, Chile]

76-000631 Schwartz, F. J.; Link, G. W. /EVERMANNELLA BALBO/ AND /REGALECUS GLESNE/ FROM THE WESTERN ATLANTIC OFF NORTH CAROLINA (PISCES: EVERMANELLIDAE AND REGALECIDAE). ASB (Assoc. Southeast. Biol.) Bull. 22 (2): 78. Apr. 1975. SFA 22(2)
[Inst. Mar. Sci., Univ. N. Car., Morehead City 28557] Two adult sabertooth fishes, /Evermannella balbo/ (158.5 and 160.2 mm standard length), and a juvenile oarfish, /Regalecus glesne/ (321.9 mm SL), were captured in the western North Atlantic off North Carolina in April 1972 and November 1973. These represent extensions of an eastern Atlantic and a circumtropical species. Specimens are compared with those from the Mediterranian and elsewhere in relation to merisitcs and morphametrics. Depth and season of capture, and the zoogeography of the two families are also reviewed.

76-000632 Sparks, R. E. ENVIRONMENTAL INVENTORY AND ASSESSMENT OF NAVIGATION POOLS 24, 25, AND 26, UPPER MISSISSIPPI AND LOWER ILLINOIS RIVERS; AN ELECTROFISHING SURVEY OF THE ILLINOIS RIVER. Ill. Nat. Hist. Surv. Contract Rep. Y-75-4. 122p. Dec. 1975. SFA 22(2)
[Ill. Nat. Hist. Surv., River Res. Lab., Havana 62644] The effect of municipal and industrial discharges from the Chicago-Joliet area was evident in electrofishing catches from the Des Plaines River--only the introduced carp and goldfish and hybrids of these two pollution-tolerant species were abundant, and most were diseased. There was a greater variety and abundance of fishes in the Illinois, compared to the Des Plaines, and the fish were generally in better condition. The greatest catches of commercial and game fishes came from La Grange and Peoria Pools (Middle Illinois River), which have the most connecting lake area. A marked improvement in relative plumpness of carp and in abundance of channel catfish was noted starting downstream from the entrance of the Sangamon River at Beardstown, attributable to availability of bottom-dwelling food organisms below Beardstown. The Upper Illinois River has improved for fish life since the 1920's. The improvement is attributable to improved oxygen levels as a result of improved waste treatment. From the 1900's to the 1950's, the backwater areas and bottomland lakes along the river served as nurseries and havens for fish and fish food organisms. In the mid 1950's, the aquatic plants and food organisms in many of these areas died out, and the areas have been seriously diminished and degraded by accumulations

76-000632 CONTINUED
of sediment, with a consequent decline in the fisheries. Although increased turbidity due to suspended sediment is likely to have affected aquatic vegetation, a causal relationship has not been conclusively demonstrated. If significant amounts of sediment, temporarily resuspended by barges on the river, move into backwater areas, then the present level of barge traffic may be having a significant impact on these critical areas.--From abstr.

76-000633 Stasiak, R. H. UPDATED DISTRIBUTIONAL RECORDS FOR SOME NEBRASKA FISHES. Proc. Nebr. Acad. Sci. Affil. Soc. 86: 27. 1976. Abstract only. SFA 22(2)

[Biol. Dep., Univ. Nebr., Omaha 68101] Systematic collecting during the past five years by personnel of the University of Nebraska and the Nebraska Game and Parks Commission has added considerable information on the current distribution of several fish species in the state. The bluntnose minnow, /Pimephales notatus/, was found in the Elkhorn River basin in Holt and Madison Counties. The northern redbelly dace, /Chrosomus eos/, and the finescale dace, /Chrosomus neogaeus/, and their hybrids occur in several small headwater streams of the Loup and Niobrara Rivers, often together with the pearl dace, /Semotilus margarita/. The blacknose dace, /Rhinichthys atratulus/, is quite common in small tributaries to the Niobrara River and has also been taken near Omaha and in the Nemaha River basin. Three minnow species were recorded in single locations: The blacknose shiner, /Notropis heterolepis/, in Keya Paha County; the sturgeon chub, /Hybopsis gelida/, in the Platte River; and the sicklefin chub, /Hybopsis meeki/, in the Missouri River at Fort Calhoun. The black buffalo, /Ictiobus niger/, previously of indeterminate status, has been collected in Carter Lake, in the city of Omaha. Iowa darters, /Etheostoma exile/, are found in the same lake. Two suckers should be added to the list of fishes in the Nemaha River basin. These are the smallmouth buffalo, /Ictiobus bubalus/, and the quillback, /Carpiodes cyprinus/.

76-000634 Wheeler, A.; Dunne, J. /TRIPTERYGION ATLANTICUS/ SP. NOV. (TELEOSTEI-TRIPTERYGIIDAE) THE FIRST RECORD OF A TRIPTERYGIID FISH IN NORTH-WESTERN EUROPE. J. Fish Biol. 7 (5): 639-649. Sept. 1975. SFA 22(2)

[Dep. Zool., British Mus. (Nat. Hist.), London SW7 5BD, England] A northward extension of the range of the family Tripterygiidae is reported. Several specimens have been captured in the vicinity of Roscoff, North Finisterre on the coast of Britanny, and presumed sight records from the English coast of the English Channel are reported. These specimens differ sufficiently from the four recognized European species to be regarded as taxonomically distinct. The name /Tripterygion atlanticus/ is proposed for this species which is formally described.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

76-000635 Ali Khan, J.; Hempel, G. RELATION OF FISH LARVAE AND ZOOPLANKTON BIOMASS IN THE GULF OF ADEN. Mar. Biol. 28 (4): 311-316. 31 Dec. 1974. SFA 22(2)

[Inst. Meereskunde, Univ. Kiel, Kiel, West Germany] This study is based on zooplankton samples collected in the upper 50 m by the F.R.V. "Manihine" in the Gulf of Aden during October-November, 1966 and February-March, 1967. Generally, the displacement volume of zooplankton varied between 20 and 67 ml/m^2. Some higher values, up to

76-000635 CONTINUED
100 ml/m², were also observed. The number of larval fish in positive hauls ranged from 2 to 282 larvae/m². An inverse relationship between the number of larval fish and the accompanying volume of zooplankton was noted. This relationship is discussed. It is hypothesized that larval mortality due to predation in the gulf of Aden during the northeast monsoon (November, February and March) was very high.

76-000636 Clady, M. D. CRUSTACEAN ZOOPLANKTON POPULATIONS AND CONCURRENT SURVIVAL OF LARVAL YELLOW PERCH IN ONEIDA LAKE. N.Y. Fish Game J. 24 (1): 46-52. Jan. 1977. SFA 22(2)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14850] Density of copepod nauplii, the primary food of larval yellow perch, was lowest in two years of good larval survival and highest in the year with poorest survival. Positive correlations between catches of larval perch and nauplii in years of high perch density, however, suggest that nauplii populations were not depleted by predation by yellow perch. Dependence of zooplankton populations on environmental factors that directly influence the survival of perch eggs and larvae probably accounts for the close correlation between perch survival and the densities of several minor food organisms, e.g., /Bosmina/ and calanoid copepods.

76-000637 Eley, R. L.; Randolph, J. C.; Miller, R. J. CURRENT STATUS OF THE LEOPARD DARTER, /PERCINA PANTHERINA/. Southwest. Nat. 20 (3): 343-354. 10 Oct. 1975. SFA 22(2)
[U.S. Army Eng. Waterways Exp. Stn., Vicksburg, MS] /Percina pantherina/, endemic to the Little River system of southeastern Oklahoma and southwestern Arkansas, is uncommon but not immediately in danger of extinction. Its collection from the Cossatot River, Arkansas, in 1971, represents an eastward extension of its known range. Existing and authorized impoundments have or will inundate or otherwise directly damage about 12 percent of approximately 3600 km of potential darter habitat. Indirect effects of impoundments probably do not pose as great a long-term threat to the leopard darter as do degradations in stream water quality due to other activities. Of the 109 known collections, 52 individuals were taken in 1971-72 for Corps of Engineers' environmental studies being conducted in response to the National Environmental Policy Act of 1969.

76-000638 Lewis, G. E. THREADFIN SHAD OVERWINTER IN A WEST VIRGINIA RESERVOIR. Prog. Fish-Cult. 39 (1): 32. Jan. 1977. SFA 22(2)
[W. Va. Dep. Nat. Resour., Romney 26757]

76-000639 Rinne, J. N. CHANGES IN MINNOW POPULATIONS IN A SMALL DESERT STREAM RESULTING FROM NATURALLY AND ARTIFICIALLY INDUCED FACTORS. Southwest. Nat. 20 (2): 185-195. 27 June 1975. SFA 22(2)
[EAFFRO, P.O. Box 1881, Kisumu, Kenya, Africa] Population dynamics and standing crops of minnows were examined in a small Upper Sonoran stream, Arizona, between 1969 and 1971. Statistics varied from year to year, largely attributable to hardiness of the respective species, increased streamflow, and flooding. Consistent yearly patterns of change in length and weight and, in most cases, biomass of all three species occurred; however, condition (K) failed to display parallel trends among species. Total biomass of fishes was comprised predominantly of one cyprinid in this small stream in the arid Southwest.

76-000640 Schwartz, F. J.; Link, G. W., Jr. STATUS OF ATLANTIC, /ACIPENSER OXYRHYNCHUS/, AND SHORTNOSE, /A. BREVIROSTRUM/, STURGEONS IN NORTH CAROLINA (PISCES, ACIPENSERIDAE). ASB (Assoc. Southeast. Biol.) Bull. 23 (2): 94. Apr. 1976. SFA 22(2)

[Inst. Mar. Sci., Univ. N. Car., Morehead City 28557] Two sturgeons, the Atlantic sturgeon (/Acipenser oxyrhynchus/) and shortnose sturgeon (/Acipenser brevirostrum/), once inhabited North Carolina waters. /A. brevirostrum/ was always considered rare or was unrecognized by fishermen. Today it is believed extinct in North Carolina. /A. oxyrhynchus/, prior to 1900, contributed at least 436, 900 lbs (198,174 kg) valued at $18,894 in 1880 to the commercial fishery. A shift in gear use, primarily from gill nets and seines (1880 to 1902), occurred to otter trawls and gill nets (since 1967). At the turn of the century specimens of 500 lb (225 kg) and 12 ft (3.7 m) were common, while today sizes rarely exceed 380 lb (172 kg) or 8.5 ft (2.6 m). Otter trawls and a single (Bogue Inlet) gill net fishery in Carteret County now account for most landings. Changes in estuarine habitats probably influenced the demise of the shortnose and reduced Altantic sturgeon populations. Movements of /A. oxyrhynchus/ are extensive. Both species have been placed on the national and IUCN rare and endangered species lists.

76-000641 Sutcliffe, W. H., Jr.; Drinkwater, K.; Muir, B. S. CORRELATIONS OF FISH CATCH AND ENVIRONMENTAL FACTORS IN THE GULF OF MAINE. J. Fish. Res. Board Can. 34 (1): 19-30. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Environ., Fish. Mar. Serv., Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada] In an investigation of catches of 17 commercial marine species of fish and shellfish from the Gulf of Maine, 10 showed statistically significant correlations with sea temperatures at St. Andrews, N.B., or Boothbay Harbour, Maine. Most fish records contained at least 40 yr of data. Descriptive equations are produced for four species based first on the correlation between catch and sea temperature and second on the correlation between catch and sea temperature allowing for fishing effort. Inclusion of fishing effort, not surprisingly, improved the correlations for all of the species so examined. The equations permitted the "prediction" of later parts of the records from earlier parts. Considering the fish species collectively, the Gulf of Maine system from 1940 to 1959 appeared to be in equilibrium with little fluctuation in the total commercial biomass. We interpret the large fluctuations in individual species abundance as resulting from a combination of fishing pressure and to a significant degree oceanic climate as represented by sea temperature. The small fluctuations in the total biomass displays the species variation, with their differing climatic "preferences," as well as possible predator (including man)-prey relationships. Environmentally imposed patterns underlie at least 50 percent of the fluctuations in catch of many species and the understanding of these fluctuations is basic to effective management.

IDENTIFICATION, KEYS, CLASSIFICATION

76-000642 Cloutman, D. G. PARASITISM IN RELATION TO TAXONOMY OF THE SYMPATRIC SIBLING SPECIES OF STONEROLLERS, /CAMPOSTOMA ANOMALUM PULLUM/ (AGASSIZ) AND /C. OLIGOLEPIS/ HUBBS AND GREENE, IN THE WHITE RIVER, ARKANSAS. Southwest. Natl 21 (1): 67-70. 20 Mar. 1976. SFA 22(2)

[Environ. Lab., Duke Power Co., Rt. 3, Box 90, Huntersville, NC 28078] Parasites were used as biological tags in relation to the

76-000642 CONTINUED
taxonomy of the two sympatric forms of stonerollers (/Campostoma anomalum pullum/ and /C. oligolepis/) in the White River, Arkansas. Nine parasite species were found. Only Neascus of /Crassiphiala bulboglossa/ had a life cycle and intensity of infection appropriate for use as a biological tag. /Crassiphiala bulboglossa/ was significantly more abundant in /C. oligolepis/ than /C. a. pullum/, suggesting that the two stoneroller forms are distinct species.

76-000643 Forey, P. L. A FOSSIL CLUPEOMORPH FISH FROM THE ALBIAN OF THE NORTHWEST TERRITORIES OF CANADA, WITH NOTES ON CLADISTIC RELATIONSHIPS OF CLUPEOMORPHS. J. Zool. (Lond.) 175 (2): 151-177. Feb. 1975. SFA 22(2)
[Dep. Zool., Univ. Alberta, Edmonton, AB, Canada] A primitive clupeomorph, /Erichalcis arcta/ gen. et sp. nov. is described from the Albian of Northwest Territories, Canada. /Erichalcis/ is uniquely specialized among clupeomorphs in the presence of enlarged lateral line scales and in the structure of the caudal skeleton. /Erichalcis/ is classified as Clupeiformes /incertae sedis/. The two recognized suborders, Clupeoidei and Denticipitoidei are examined with respect to primitive and derived character states. It is concluded that the clupeoids and denticipitoids are divergently specialized in details of the union between the supraorbital and infraorbital sensory canals and the recessus lateralis. It is further suggested that the reduction in size and the posterior shift of the dermosphenotic in clupeoids is correlated with an upper division of the levator arcus palatini muscle and an antero-dorsal process on the hyomandibular. Cladistic relationships of some Cretaceous clupeomorphs are proposed and it is suggested that /Diplomystus brevissimus/ Cope not be included in the Clupeoidei.

76-000644 Greenwood, P. H. A NEW AND EYELESS COBITID FISH (PISCES, CYPRINIFORMES) FROM THE ZAGROS MOUNTAINS, IRAN. J. Zool. (Lond.) 180 (1): 129-137. Sept. 1976. SFA 22(2)
[British Mus. (Nat. Hist.), London, England] The first blind, and colourless, noemacheiline cobitid fish is described and compared with other cave-dwelling species of the subfamily. The new taxon, recently discovered in a natural well connected with subterranean waters in the Zagros Mountains of Iran, coexists with the blind depigmented cyprinid fish /Iranocypris typhlops/ discovered in 1937. Some consideration is given to the generic status of the new species and its relationships to other noemacheilines.

76-000645 Hubbs, C. L.; Miller, R. R. /NOTROPIS TROPICUS/, A NEW CYPRINID FISH FROM EASTERN MEXICO. Southwest. Nat. 20 (1): 121-131. 15 May 1975. SFA 22(2)
[Scripps Inst. Oceanogr., La Jolla, CA 92037]

76-000646 Manooch, C. S. III.; Huntsman, G. R.; Sullivan, B.; Elliott, J. CONSPECIFIC STATUS OF THE SPARID FISHES /PAGRUS SEDECIM/ GINSBURG AND /PAGRUS PAGRUS/ LINNAEUS. Copeia. 1976 (4): 678-684. 30 Dec. 1976. SFA 22(2)
[NMFS, Atl. Estuarine Fish. Cent., Beaufort, NC 28516]

76-000647 Miller, R. R.; Echelle, A. A. /CYPRINODON TULAROSA/, A NEW CYPRINODONTID FISH FROM THE TULAROSA BASIN, NEW MEXICO. Southwest. Nat. 19 (4): 365-377. 20 Jan. 1975. SFA 22(2)
[Mus. Zool., Univ. Mich., Ann Arbor 48104]

76-000648 Miller, R. R. FOUR NEW PUPFISHES OF THE GENUS /CYPRINODON/ FROM MEXICO, WITH A KEY TO THE /C. EXIMIUS/ COMPLEX. Bull. South. Calif. Acad. Sci. 75 (2): 68-75. Aug. 1976. SFA 22(2)
[Mus. Zool., Univ. Mich., Ann Arbor 48109]

76-000649 van der Elst, R. P.; Wallace, J. H. IDENTIFICATION OF THE JUVENILE MULLET OF THE EAST COAST OF SOUTH AFRICA. J. Fish Biol. 9 (4): 371-374. Oct. 1976. SFA 22(2)
[Oceanogr. Res. Inst., Durban, South Africa] Juvenile mullet are identified at the stage at which they first enter estuaries (10-50 mm in most species) through the use of dentition characteristics and lateral line scale counts. Techniques which simplify the determination of these features are described and a key to the 15 South African species is provided.

76-000650 Vari, R. P. THE FAMILY TERAPONIDAE (PISCES: PERCOIDEI): INTERRELATIONSHIPS, TAXONOMY, AND ZOOGEOGRAPHY. Ph. D. dissertation, City Univ. N.Y. 509p. 1976. SFA 22(2)
Using the methods of phylogenetic and biogeographic analysis put forward by Hennig and Croizat respectively, the following results were obtained: 1) the family can be defined on the basis of derived states of the swimbladder, extrinsic swimbladder muscle, urohyal and third epibranchial. 2) the above characters fail to support the inclusion of the genera /Datnioides/ and /Pseudohelotes/ in the Teraponidae as suggested by Fowler. Neither these characters nor any others were found to support a hypothesis of a sister group relationship between teraponids and any other group of percoids. 3) within the family 15 monophyletic assemblages were recognized, with the relationships between them and their defining characters based on derived states of the posttemporal, tabular, dentary, maxillary, premaxillary, spinous dorsal, and vertebral osteology; forms of the extrinsic swimbladder muscle, swimbladder and intestinal patterns; and differences in body pigmentation and heights of the dorsal and anal fin sheaths. 4) these monophyletic assemblages are recognized at the generic level, with three new genera (/Hannia/, /Lagusia/, and /Syncomistes/) described in the work. Thirty seven species are recognized (five described for the first time) with each species described in detail and a key provided to the species of the family. Eight species recognized as distinct by some or all workers to this point are placed in synonymy and one species synonymized earlier is recognized as distinct. 5) analysis of the zoogeography of the family and its subunits revealed two major patterns: A) a track including the costal regions of the entire Indo-west Pacific. B) a track between the freshwaters of northern Australia and southern New Guinea.--From abstr.

76-000651 Vladykov, V. D.; Kott, E. A NEW NONPARASITIC SPECIES OF LAMPREY OF THE GENUS /ENTOSPHENUS/ GILL, 1862, (PETROMYZONIDAE) FROM SOUTH CENTRAL CALIFORNIA. Bull. South. Calif. Acad. Sci. 75 (2): 60-67. Aug. 1976. SFA 22(2)
[Dep. Biol., Univ. Ottawa, Ottawa, ON, Canada]

76-000652 Webb, C. J.; Miller, P. J. A REDESCRIPTION OF /POMATOSCHISTUS NORVEGICUS/ (COLLETT, 1903) (TELEOSTEI: GOBIOIDEI) BASED ON SYNTYPE MATERIAL. J. Fish Biol. 7 (6): 735-747. Nov. 1975. SFA 22(2)

[Dep. Zool., Univ. Bristol, Bristol BS8 1UG, England] A deeper water species of the Mediterranean-Atlantic gobiid genus /Pomatoschistus, P. norvegicus/ (Collett, 1903), is redescribed from syntype material, including details of the lateral-line system and a summary of geographical distribution. The systematic status of /P. norvegicus/ is briefly discussed with reference to the other nominal species, /P. minutus/ (Pallas) and /P. lozanoi/ (De Buen), of the '/P. minutus/' complex.

PARASITES AND DISEASES-GENERAL

76-000653 Corbel, M. J. THE IMMUNE RESPONSE IN FISH: A REVIEW. J. Fish Biol. 7 (4): 539-563. July 1975. SFA 22(2)

[Minist. Agric. Fish. Food, Cent. Vet. Lab., Weybridge, Surrey KT15 3NB, England] The literature relating to the immune response of fish has been reviewed. Non-specific immune mechanisms similar to those of other vertebrate classes occur in fish. Similarly specific cell-mediated immunity has been demonstrated at all levels of evolution, from the cyclostomes to the teleosts. A humoral antibody system also occurs in all classes of fish but varies considerably in relation to phylogenetic status. In the cyclostomes, only immunoproteins with properties intermediate between the immunoglobulins of vertebrates and the non-specific agglutinins and lysins of invertebrates have been demonstrated. In the elasmobranchs and chondrosteans 7 and 19s immunoglobulins of IgM type occur. In holosteans the 19s form is predominant whereas in teleosts, 7 and 19s forms occur, with some evidence of specialization in the 7s form. In the phylogenetically most advanced fish, the Dipnoi, two immunoglobulin classes, structurally analogous to IgM and IgG, have been described. A characteristic feature of both cell-mediated and antibody mediated immune responses in fish is their dependence upon environmental temperature. There is also evidence that, in some species at least, nutritional factors and behaviour patterns may also influence the immune response. Attempts at artificial immunization of fish against infectious desease have met with varied success. It is probable that better results could be achieved with live vaccine strains, particularly if applied under conditions optimal for the immune responses.

76-000654 Harris, J. E.; Cottrell, B. J. PRECIPITATING ACTIVITY IN THE SERA OF PLAICE, /PLEURONECTES PLATESSA/ L. TO A HELMINTH ANTIGEN. J. Fish Biol. 9 (5): 405-410. Nov. 1976. SFA 22(2)

[Dep. Environ. Sci., Plymouth Polytech., Drake Circus, Plymouth, Devon, England] An antigen abstract of /Proleptus obtusus/ an intestinal nematode of the common dogfish has been shown to precipitate with a serum component of plaice. As the parasite has never been shown to infect plaice it is suggested that perhaps the serum component might be C-reactive protein (CRP). However, characterization of the component revealed that it was specific immunoglobulin analagous to antibody of the IgM class. It is suggested the helminth antigen involved is cross-reacting with a common antigen to which the plaice is normally exposed.

76-000655 Hoffman, G. L. FISH DISEASES AND PARASITES IN RELATION TO THE ENVIRONMENT. Fish Pathol. 10 (2): 123-128. 1976. SFA 22(2)
[U.S. FWS, Fish Farm. Exp. Stn., Stuttgart, AR 72160] Although some diseases are not affected by subtle environmental changes, others are. Factors which may influence infection or the course of disease are: temperature, gaseous supersaturation, oxygen deficiency, mechanical and physiological trauma of the fish, malappropriate water chemistry, pollution, eutrophication, media for spore retention, and presence of intermediate hosts. Avitaminoses and neoplasias are often related to environmental changes.

76-000656 Paperna, I.; Zwerner, D. E. PARASITES AND DISEASES OF STRIPED BASS, /MORONE SAXATILIS/ (WALBAUM), FROM THE LOWER CHESAPEAKE BAY. J. Fish Biol. 9 (3): 267-287. Sept. 1976. SFA 22(2)
[Heinz Steinitz Mar. Biol. Lab., P.O. Box 469, Elat, Israel] A survey to determine presence of parasitic and disease organisms and their effect on estuarine populations of striped bass, /Morone saxatilis/ (Walbaum), was conducted monthly from May 1972 to May 1973. A total of 514 fish over 1 year old and 140 young-of-the-year were examined using standard necropsy and histological procedures. Other species of fishes were studied to determine the specificity of striped bass parasites and to determine if other fishes were reservoirs for striped bass pathogens. Forty-five species of parasitic organisms from viruses to Metazoa were recognized from striped bass. Heavy infections by some were associated with definite pathological conditions.

76-000657 Racicot, J. G.; Gaudet, M.; Leray, C. BLOOD AND LIVER ENZYMES IN RAINBOW TROUT (/SALMO GAIRDNERI/ RICH.) WITH EMPHASIS ON THEIR DIAGNOSTIC USE: STUDY OF CCl(4) TOXICITY AND A CASE OF /AEROMONAS/ INFECTION. J. Fish Biol. 7 (6): 825-835. Nov. 1975. SFA 22(2)
[C. Leray: Lab. Physiol. Comp. Reg., B.P. 20 CR 67037, Strasbourg-Cedex, France] The effect of one intraperitoneal injection of 1.33 ml of CCl(4) per kg of fish was studied. Two experimental series were performed and studied for 10 days (with diluent) and 24 h (pure CCl(4)) periods. LDH, GOT, GPT, GR, GDH, CPK, G-6-Pase, and AlkPase were studied. The activity of all enzymes in blood increased: LDH (four times the control), GOT (two times), GPT (three times); they reached a maximal activity 12 h after injection of diluted CCl(4). The levels of some enzymes were also examined in the liver. With pure CCl(4), maximal enzyme activity in blood occurred earlier (6h). A 6 to 10 times increase was observed for GOT, GPT, LDH, GR, and GDH. Histopathological observations were correlated with these enzyme studies. A /Aeromonas/ disease characterized by the destruction of the dermis, the exposure of the muscle, and by the presence of numerous petechiae in the liver enabled us to examine the relationships between naturally induced tissue damage and enzyme levels in blood. The levels of seven blood enzymes were determined and the most significant modifications were observed for LDH and CPK which increased their concentration from 3 to 7 times respectively. A pyruvate saturation test demonstrated that LDH was probably from liver as it was observed after CCl(4) poisoning. The contribution of such biochemical studies in fish research is evaluated.

BACTERIAL DISEASES

76-000658 Ehlinger, N. F. SELECTIVE BREEDING OF TROUT FOR RESISTANCE TO FURUNCULOSIS. N.Y. Fish Game J. 24 (1): 25-36. Jan. 1977. SFA 22(2)

Results, subsequent to those previously published, concerning efforts to develop furunculosis resistance in strains of brook trout (/Salvelinus fontinalis/) and brown trout (/Salmo trutta/) are reported. Crossing resistant strains produced no further significant increase in the level of resistance, so techniques employing individual matings were attempted. Limited field testing of resistant strains was generally encouraging but suggested that a selected furunculosis-resistant strain of brook trout may be more susceptible to gill disease. Project setbacks from flooding and extraneous diseases, as well as difficulties in efforts to field test resistant strains, are discussed.

76-000659 Suzumoto, B. K.; Schreck, C. B.; McIntyre, J. D. RELATIVE RESISTANCES OF THREE TRANSFERRIN GENOTYPES OF COHO SALMON (/ONCORHYNCHUS KISUTCH/) AND THEIR HEMATOLOGICAL RESPONSES TO BACTERIAL KIDNEY DISEASE. J. Fish. Res. Board Can. 34 (1): 1-8. Jan 1977. In English with French summ. SFA 22(2)

[Oreg. Coop. Fish. Res. Unit, Oreg. State Univ., Corvallis 97331] Juvenile coho salmon (/Oncorhynchus kisutch/) of three transferrin genotypes (/AA/, /AC/, and /CC/) were experimentally infected with the causative agent of bacterial kidney disease (BKD) and mortalities observed. Six experimental and control groups were used: 1) bacteria-infected + no Fe^{+3}; 2) bacteria-infected + low Fe^{+3} levels; 3) bacteria-infected + high Fe^{+3} levels; 4) saline control; 5) high Fe^{+3} control; and 6) low Fe^{+3} control. In all experimental groups, the /AA/ genotype was the most susceptible to BKD and the /CC/ genotype the most resistant. Addition of exogenous iron did not appear to increase the pathogenicity of the disease. Distribution and uptake of radioiron (^{59}Fe) in control and BKD-infected fish was studied. BKD-infected fish were found to have consistently higher levels of ^{59}Fe in whole blood, plasma, and liver than control fish. In control and experimental fish, spleen, head kidney, and liver tissues were found to accumulate ^{59}Fe, while white muscle and gall bladder tissues did not. The effect of BKD on certain hematological characteristics also was determined. Hemoglobin, packed cell volume, total plasma protein, plasma iron, and plasma corticoid levels all may have decreased with the progression of BKD.

PROTOZOAN DISEASES

76-000660 Current, W. L.; Janovy, J., Jr. ULTRASTRUCTURE OF INTERLAMELLAR /HENNEGUYA EXILIS/ IN THE CHANNEL CATFISH. J. Parasitol. 62 (6): 975-981. Dec. 1976. SFA 22(2)

[Sch. Life Sci., UN-L, Lincoln, NE 68588] Ultrastructural aspects of interlamellar /Henneguya exilis/ infections in channel catfish are reported. The plasmodium wall of this form differs from that of other species in that it is composed of two outer unit membranes which give rise to a zone of numerous pinocytic canals. Single-membraned canals appeared to be a stable feature of the wall while double-membraned canals are interpreted as those actively carrying out pinocytosis. Evidence suggests that host cellular cytoplasm as well as interstitial material is taken in by plasmodia. Plasmodium wall integrity,

76-000660 CONTINUED
aggregation of parasite ectoplasmic components, numbers of pinocytic canals, and number of mitochondria proximal to the wall vary among different plasmodium profiles and may be related to plasmodium maturity. The parasite causes extensive hyperplasia of basal cells, which in turn replaces most other cell types found in noninfected gill filaments. Cytoarchitectual differences between basal cells of noninfected filaments and basal cells adjacent to plasmodia include significantly shorter microfilament boundles in the latter.

76-000661 Daniels, S. B.; Herman, R. L.; Burke, C. N. FINE STRUCTURE OF AN UNIDENTIFIED PROTOZOON IN THE EPITHELIUM OF RAINBOW TROUT EXPOSED TO WATER WITH /MYXOSOMA CEREBRALIS/. J. Protozool. 23 (3): 402-410. Aug. 1976. SFA 22(2)
[Dep. Pathobiol., Univ. Conn., Storrs 06268] An intracellular protozoon was discovered in the epithelium of young rainbow trout (/Salmo gairdneri/) exposed for as short a time as 1 hr to water known to contain infective stages of /Myxosoma cerebralis/. Light- and electron-microscopic examination of this tissue revealed what appeared to be a proliferative stage (presumptive schizont) of a sporazoon; other possible stages in the life cycle were also observed. The relationship of this unidentified protozoon to /M. cerebralis/ remains unresolved.

76-000662 Davies, A. J.; Johnston, M. R. L. THE BIOLOGY OF /HAEMOGREGARINA BIGEMINA/ LAVERAN & MESNIL, A PARASITE OF THE MARINE FISH /BLENNIUS PHOLIS/ LINNAEUS. J. Protozool. 23 (2): 315-320. May 1976. SFA 22(2)
[Cytopathol. Unit, St. Halier Hospital, Carshalton, Surrey, SM5 1AA, England] /Haemogregarina bigemina/ was found in all /Blennius pholis/ which exceeded 5.0 cm in length, but in none measuring less than 3.5 cm. No exoerythrocytic development was recorded. The first /B. pholis/ eggs hatched in May while the first patent infections of /H. bigemina/ occurred from September onward in metamorphosed fish. Consequently, if the life cycle of /H. bigemina/ includes a vector, that organism is active between May and September at least. Circumstantial evidence indicates that the hematophagous isopod, /Gnathia maxillaris/ and not leeches, could be a vector of /H. bigemina/. Developmental stages of sporazoa were found in a small number of the isopods which had fed on infected /B. pholis/ but the parasites could not be identified as /H. bigemina/ with certainty. Subcellular organization, typical of sporazoa, was recorded by electron microscopy of /H. bigemina/.

76-000663 Halliday, M. M. THE BIOLOGY OF /MYXOSOMA CEREBRALIS/: THE CAUSATIVE ORGANISM OF WHIRLING DISEASE OF SALMONIDS. J. Fish Biol. 9 (4): 339-357. Oct. 1976. SFA 22(2)
[Joseph Johnston & Sons Ltd., 3 America St., Montrose, DD10 8RE, Scotland] The literature describing the biology and control of /Myxosoma cerebralis/ (whirling disease) is reviewed. New data on the world distribution of the parasite are presented. It is concluded that the presence of /M. cerebralis/ is not an important limiting factor in salmonid farming /per se/ but only limits methods of production.

76-000664 Hoffman, G. L. PROTOZOAN DISEASE OF FRESHWATER FISHES, ADVANCES AND NEEDS. Proc. Int. Wildl. Dis. Conf. 3. 1976. In English with German summ. SFA 22(2)
[U.S. FWS, Fish Farm. Exp. Stn., Stuttgart, AR 72160] A brief review of the most important protozoan problems in the U.S.A. is given. More precise identification of protozoa is needed in order to better control the most pathogenic species. Because of the dangerous /Myxoxoma cerebralis/, /Ceratomyxa shasta/, and /Henneguya/ of catifsh, other myxosporideans are being watched more closely. Better control methods are needed. /Ichthyophthirius multifiliis/ continues to be a world-wide problem; better therapy is needed.

76-000665 Love, M. S.; Moser, M. /DAVISIA REGINAE/ SP. N. (PROTOZOA: MYXOSPORIDA) FROM FOUR CALIFORNIA MARINE FISHES. J. Parasitol. 62 (6): 982-983. Dec. 1976. SFA 22(2)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106] /Davisia reginae/ sp. n. was found in the urinary bladders of the olive rockfish, /Sebastes serranoides/; quillback rockfish, /S. maliger/; striped surfperch, /Embiotoca lateralis/; and pile surfperch, /Damalichthys vacca/. This new /Davisia/ belongs to the group whose lateral appendages are "solid."

76-000666 Loyacano, H. A., Jr.; Crane, J. S. CONTROL OF /ICHTHYOPHTHIRIUS/ ON THE AMERICAN EEL. Prog. Fish-Cult. 39 (1): 39-40. Jan. 1977. SFA 22(2)
[Dep. Entomol. Econ. Zool., Clemson Univ., Clemson, SC 29631]

76-000667 McVicar, A. H. INFECTION OF PLAICE /PLEURONECTES PLATESSA/ L. WITH /GLUGEA (NOSEMA) STEPHANI/ (HAGENMULLER 1899) (PROTOZOA: MICROSPORIDIA) IN A FISH FARM AND UNDER EXPERIMENTAL CONDITIONS. J. Fish Biol. 7 (5): 611-619. Sept. 1975. SFA 22(2)
[D.A.F.S., Mar. Lab., Torry, Aberdeen, Scotland] One tank of plaice in the W.F.A. Fish Cultivation Unit at Hunterston, known to harbour an infection with the microsporidian /Glugea stephani/, was sampled over a 2 year period and showed a mean level of infection of 49.4 percent with an apparent trend towards a decrease. Experimental oral transmission was achieved, without the use of intermediate or carrier hosts, and the dependence of /G. stephani/ on high temperatures was demonstrated. Most fish were able to tolerate the infection, but some mortalities in young fish were attributed to the parasite, particularly in the 2 months following the experimental infection. The parasite in the fish farm is believed to have been introduced with plaice stocks imported from more southern waters.

76-000668 Moser, M.; Noble, E. R.; Lee, R. S. THE GENUS /MYXIDIUM/ (PROTOZOA: MYXOSPORIDA) IN MACROURID FISHES. J. Parasitol. 62 (5): 685-689. Oct. 1976. SFA 22(2)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106] Five species, 3 new, of myxosporida in the genus /Myxidium/ were recovered from 7 genera and 23 species of deepsea macrourids. Although some /Myxidium/ species were geographically dispersed they showed remarkable spore size stability. Two forms, "long" and "stubby" are described for /M. coryphaenoidium/. Abnormal /M. coryphaenoidium/ spores are shown to resemble superficially other species and genera.

76-000669 Moser, M.; Noble, E. R. THE GENUS /LEPTOTHECA/ (PROTOZOA: MYXOSPORIDA) IN MACROURID FISHES AND SABLEFISH, /ANOPLOPOMA FIMBRIA/. J. Protozool. 23 (4): 490-492. Nov. 1976. SFA 22(2)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106] Five species of /Leptotheca/, one new, were found in the macrourid fishes and the sablefish, /Anoplopoma fimbria/. Those species which were geographically widespread in numerous host species show little variation. Two /Leptotheca/ species were found both in the gall bladder and urinary bladder/kidney.

76-000670 Moser, M.; Love, M. S.; Jensen, L. A. MYXOSPORIDA (PROTOZOA) IN CALIFORNIA ROCKFISH, /SEBASTES/ SPP. J. Parasitol. 62 (5): 690-692. Oct. 1976. SFA 22(2)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106] Six genera and 15 species, 2 new, of myxosporida were recovered from 14 species of California marine rockfish, /Sebastes/. The spores of /Leptotheca sebasta/ sp. n. are arched with thick, equal shell valves and large round polar capsules. They are greater in width and sutural diameter and more crescentic than /L. latesi/. /Ceratomyxa sebasta/ sp. n. is crecentic in shape with equal shell valves. The spores of /C. sebasta/ are shorter in sutural diameter, larger in width, and less crescentic than /C. hokarari/.

76-000671 Nagel, M. L.; Summerfelt, R. C. NITROFURAZONE FOR CONTROL OF THE MICROSPORIDAN PARASITE /PLEISTOPHORA OVARIAE/ IN GOLDEN SHINERS. Prog. Fish-Cult. 39 (1): 18-23. Jan. 1977. SFA 22(2)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74074] In a test of the efficacy of nitrofurazone to control infection of the Microsporidan parasite /Pleistophora ovariae/ in ovaries of golden shiners (/Notemigonus crysoleucas/), the chemical was fed at levels of 1.10, 1.65, 2.20, 3.30, 5.51, and 7.71 g active ingredient per kilogram of feed (50-350 g/100 lb). The dosage response was nonlinear; maximal drug effect on incidence of infection was at a dose of 2.20 g and maximal effect on intensity of infection was at 3.30 g. The net production of shiners (not evaluated at the three highest treatment levels) was reduced in a pond in which the fish were given the 2.20-g treatment, suggesting that high levels of this drug may inhibit gonad development. None of the dosages tested yielded a complete cure.

76-000672 Olson, R. E. LABORATORY AND FIELD STUDIES ON /GLUGEA STEPHANI/ (HAGENMULLER), A MICROSPORIDAN PARASITE OF PLEURONECTID FLATFISHES. J. Protozool. 23 (1): 158-164. Feb. 1976. SFA 22(2)
[Dep. Zool., Oreg. State Univ., Mar. Sci. Cent., Newport 97365] The microsporidan /Glugea stephani/ is a common parasite of juvenile English sole (/Parophrys vetulus/) in Raquina Bay, Oregon. Field observations indicated that fish became infected only in the upper estuary where summer temperatures were above 15 C and the incidence of infection reached 79.8 percent in the late fall. Laboratory infections developed and parasite growth occurred only at or above 15 C. The parasite was successfully trasmitted to juvenile English sole by brine shrimp (/Artemia salina/) and amphipod (/Corophium spinicorne/) vectors as well as by direct ingestion of spore-carrying vectors were much heavier than those resulting from the direct ingestion of spores. The speckled sanddab (/Citharichthys stigmaeus/), a nonpleuronectid flatfish, and chum salmon (/Oncorhynchus keta/) were refractory to /G. stephani/ infection in the laboratory. Results of this study suggest that /G. stephani/ is potentially lethal to young pleuronectid flatfishes when heavy infections involve the entire intestine and reduce the capacity to absorb nutrients. Under these circumstances, starvation is probably the direct or indirect cause of death. The

76-000672 CONTINUED
restriction of infection to fish that reach the upper estuary very likely mitigates the impact of /G. stephani/ caused mortality on the entire English sole population on the Yaquina Bay nursery ground.

76-000673 Wolf, K.; Markiw, M. E. /MYXOSOMA CEREBRALIS/: /IN VITRO/ SPORULATION OF THE MYXOSPORIDAN OF SALMONID WHIRLING DISEASE. J. Protozool. 23 (3): 425-427. Aug. 1976. SFA 22(2)
[U.S. FWS, East Fish Dis. Lab., Kearneysville, WV 25430] Trophozoites and other pre-spore stages of the myxosporidan /Myxosoma cerebralis/ were taken from infected rainbow trout (/Salmo gairdneri/) and cultured /in vitro/. Cultures eventually yielded mature spores capable of discharging their polar capsules. This is the first report of culture of a myxosporidan.

OTHER DISEASES AND PARASITES

76-000674 Banhawy, M. A.; Saoud, M. F. A.; Anwar, I. M.; Naffar, M. K. THE HISTOPATHOLOGICAL EFFECTS OF THE PARASITIC TAPEWORM /WENYONIA VIRILIS/ ON THE ILEUM AND LIVER OF THE SILURID FISH /SYNODONTIS SCHALL/. Ann. Zool. (Agra) 11 (4): 83-101. Oct. 1975. SFA 22(2)
[Fac. Sci., Ain Shams Univ., Cairo, Egypt] The present study deals with the histopathological changes produced in the ileum and liver of the fish, /Synodontis schall/, by infection with the parasitic tapeworm, /Wenyonia virilis/. Twenty fish, including uninfected, lightly infected, and heavily infected ones, were studied. The structure of the ileum and the liver of the fish undergoes marked alteration as a result of the infection, and the component tissues showed clear signs of deterioration, but the extent of such alterations varies considerably according to the intensity of the infection.

76-000675 Bauer, O. N.; Hoffman, G. L. HELMINTH RANGE EXTENSION BY TRANSLOCATION OF FISH. IN L. A. Page, ed. Wildlife Deseases. Plenum Publ. Corp., 227 W. 17th St., New York, NY. p. 163-172. 1976. In English with German summ. SFA 22(2)
[Zool. Inst., Acad. Sci., Leningrad, USSR] Since 1850 the geographical ranges of many helminths of fish have increased as a result of the intercontinental and transcontinental transportation of parasitized fish due to transportation. The ease with which helminths are established in new areas depends on the complexity of the life cycle. Helminths such as Monogenoidea, which develop without intermediate hosts and in which swimming larvae infest fish, have been most frequently transferred. They have been moved to new continents with food, sport, and ornamental fish. Monogeneans have been translocated from Europe to North America and vice versa, and from East Asia to Europe. The establishment of helminth requiring two hosts has been less frequent, but a considerable number have been transferred and a few have become widely distributed. Cestodes (Proteocephalidae, Bothriocephalidae) and nematodes (Philometridae) that develop in cosmopolitan copepods or oligochaetes (Caryophyllaeidae) have also been transferred. Helminths which have more than two hosts and a complicated life cycle, such as trematodes, are usually not successfully introduced with the fish host. The translocation of dangerous fish parasites can be avoided by inspection of the fish and the control and eradication of the parasites before the fish are shipped.

76-000676 Beverley-Burton, M.; Nyman, O. L.; Pippy, J. H. C. THE MORPHOLOGY, AND SOME OBSERVATIONS ON THE POPULATION GENETICS OF /ANISAKIS SIMPLEX/ LARVAE (/NEMATODA: ASCARIDATA) FROM FISHES OF THE NORTH ATLANTIC. J. Fish. Res. Board Can. 34 (1): 105-112. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Zool., Coll. Biol. Sci., Univ. Guelph, Guelph, ON N1G, 2W1, Canada] The morphology of larval /Anisakis simplex/ in a subsample taken from Atlantic herring, /Clupea harengus harengus/, in the North Sea (and used in previous in vitro culture experiments) is described, with particular reference to the excretory system. The morphological similarities of these larvae from /C. harengus harengus/ and Atlantic salmon, /Salmo salar/, taken in widely separated locations in the North Atlantic suggests that /Anisakis/ larvae Type 1 is /A. simplex/. These findings are substantiated by studies on acid phosphatase polymorphism of the larvae and the known geographic ranges of related species. Frequencies of the acid phosphatase phenotypes varied in different sampling areas, suggesting that different populations of larval /A. simplex/ occur in fish in the North Atlantic.

76-000677 Brooks, D. R.; Thorson, T. B. TWO TETRAPHYLLIDEAN CESTODES FROM THE FRESHWATER STINGRAY /POTAMOTRYGON MAGDALENAE/ DUMERIL 1852 (CHONDRICHTHYES: POTAMOTRYGONIDAE) FROM COLOMBIA. J. Parasitol. 62 (6): 943-947. Dec. 1976. SFA 22(2)

[Gulf Coast Res. Lab., P.O. Box A.G., Ocean Springs, MS 39564] Two new tetraphyllidean cestodes are described from the freshwater stingray /Potamotrygon magdalenae/ from Colombia. The new genus /Potamotrygonocestus/ is proposed for /P. magdalenensis/, which differs from /Pedibothrium/ by having a bilobed rather than X-shaped ovary, and simple rather than bifid hooks. It further differs from /Pachybothrium hutsoni/ by having bothridial hooks inserted immediately posterior to an accessory sucker rather than inserted in the middle of a thick muscular pad. /Potamotrygonocestus magdalenensis/ is unique among known tetraphyllideans by possessing vetellaria which are compact, cylincrical bands in the lateral portions of the middle of the proglottid. The second new species, /Rhinebothrium moralarae/, resembles /R. scorzai/ by having its genital pore and terminal genitalia at the ovarian level, greatly reduced poral ovarian lobes, and by parasitizing a freshwater stingray. It differs from /R. scorzai/ in number of bothridial loculi, testes per proglottid, and proglottids per strobila; by having quadrate rather than canoe-shaped bothridia; and by parasitizing /Potamotrygon magdalenae/ rather than /P. hystrix/.

76-000678 Bucke, D.; McCarthy, D.; Hill, B. A REPORT OF SUSPECTED ERYTHRODERMATITIS IN CARP IN GREAT BRITAIN. J. Fish Biol. 7 (3): 301-303. May 1975. SFA 22(2)

[Huntingdon Res. Cent., Huntingdon PE18 6ES, England] An epizootic in imported carp (/Cyprinus carpio/ L.) was examined by bacteriological, virological and histological methods. The microbiological investigations did not reveal the aetiology of the disease, but the histological description of the lesions is similar to that for carp erythrodermatitis 'CE'.

76-000679 Buckner, R. L.; Buchner, S. C. A NEW SPECIES OF /LEPTORHYNCHOIDES/ KOSTYLEV 1924 (ACANTHOCEPHALA) FROM THE PIRATE PERCH, /APHREDODERUS SAYANUS/ (GILLIAMS). J. Parasitol. 62 (6): 955-958. Dec. 1976. SFA 22(2)

[Div. Sci. Math., Ind. State Univ., 8600 University Blvd., Evansville 47712] /Leptorhynchoides aphredoderi/ sp. n. is described from specimens recovered from pirate perch, /Aphredoderus sayanus/, collected in southeastern Louisiana. The new species is distinguished by having more longitudinal rows of proboscis hooks (15 to 18) than any other species of /Leptorhynchoides/. It differs additionally from /L. thecatus/ and /L. plagicephalus/ in having a shorter trunk, proboscis, proboscis receptacle, and proboscis hooks. Eggs of the new species are much larger than those of /L. thecatus. /L. aphredoderi/ differs further from /L. plagicephalus/ in having fewer proboscis hooks in each longitudinal row and wider eggs. /L. aphredoderi/ differs additionally from /L. campbelli/ in having more proboscis hooks in each longitudinal row and much longer eggs.

76-000680 Burreson, E. M. /TRACHELOBDELLA OREGONENSIS/ SP. N. (HIRUDINEA: PISCICOLIDAE), PARASITIC ON THE CABEZON, /SCORPAENICHTHYS MARMORATUS/ (AYRES), IN OREGON. J. Parasitol. 62 (5): 793-798. Oct. 1976. SFA 22(2)

[Normandeau Assoc., Inc., Nashua Rd., Bedford, NH 03102] /Trachelobdella oregonensis/ sp. n., parasitic on /Scorpaenichthys marmoratus/ from Oregon is described. All individuals examined had 1 pair of eyes, 10 pairs of pulsatile vesicles and were uniformly dark purple except for the posterior sucker and last few annuli of the urosome which were unpigmented. Individuals newly hatched from cocoons are mature males and only these small leeches possess testisacs.

76-000681 Cochran, M. L. B. A TAXONOMIC AND DISTRIBUTIONAL STUDY OF NEMATODE PARASITES IN FRESHWATER FISHES OF ALABAMA. Ph. D. dissertation, Auburn Univ. 156p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

A total of 962 individual fishes of 79 different species were examined for parasitic nematodes. The fishes examined were collected from 22 locations in Alabama and 2 locations in Georgia.--From abstr.

76-000682 Dailey, M. D.; Carvajal, J. HELMINTH PARASITES OF /RHINOBATOS PLANICEPS/ GARMAN 1880, INCLUDING TWO NEW SPECIES OF CESTODES, WITH COMMENTS ON HOST SPECIFICITY OF THE GENUS /RHINEBOTHRIUM/ LINTON 1890. J. Parasitol. 62 (6): 939-942. Dec. 1976. SFA 22(2)

[Dep. Biol., Calif. State Univ., Long Beach 90840] /Rhinebothrium rhinobati/ sp. n. and /Prochristianella heteracantha/ sp. n. are described from the skate, /Rhinobatos planiceps/ Garman 1880 from Chile. New Host records and locations are reported for /Acanthobothrium olseni/ Dailey and Mudry 1969, /Parachristianella monomegacantha/ Kruse 1959, and /Proleptus acutus/ Dujardin 1845. The genus /Rhinebothrium/ is reported from the host family Rhinobatidae for the first time and the host specificity of the genus /Rhinebothrium/ to the Myliobatidae is discussed.

76-000683 Hanan, D. A. A NEW SPECIES OF CYCLOPOID COPEPOD, PARASITIC ON SHINER SURFPERCH, /CYMATOGASTER AGGREGATA/ GIBBONS, IN ANAHEIM BAY AND HUNTINGTON HARBOR, CALIFORNIA, WITH NOTES ON /BOMOLOCHUS CUNEATUS/ FRASER AND /ERGASILUS LIZAE/ KROYER. Bull. South. Calif. Acad. Sci. 75 (1): 22-28. May 1976. SFA 22(2)
[Dep. Biol., Calif. State Univ., Long Beach 90840] Three species of parasitic cyclopoid copepods are reported from the Shiner Surfperch, /Cymatogaster aggregata/ Gibbons, collected from Anaheim Bay and Huntington Harbor, California. One of the copepods, /Holobomolochus embiotocae/, new species, of the family Bomolochidae inhabits the nasal cavity of the shiner perch. The other two copepods, /Bomolochus cuneatus/ Fraser and /Ergasilus lizae/ Kroyer, are reported as new host and locality records.

76-000684 Hayunga, E. G.; Grey, A. J. /CYSTOBRANCHUS MEYERI/ SP. N. (HIRUDINEA: PISCICOLIDAE) FROM /CATOSTOMUS COMMERSONI/ LACEPEDE IN NORTH AMERICA. J. Parasitol. 62 (4): 621-627. Aug. 1976. SFA 22(2)
[Dep. Biol. Sci., State Univ. N.Y., 1400 Washington Ave., Albany 12222] /Cystobranchus meyeri/ sp. n. (Hirudinea: Piscicolidae) is described from the white sucker, /Catostomus commersoni/ Lacepede (Osteichthyes: Catostomidae) from the Mohawk River drainage of eastern New York. Size, details of internal anatomy, and the presence of 8 ocelli on the posterior sucker distinguish it from the 3 other species in North America. A table compares the members of this genus and a key to the species is included. Problems of classification, host records, and host specificity are discussed.

76-000685 Isaacson, P. A. THEORETICAL CONSIDERATION OF THE CAUSE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT. N.Y. Fish Game J. 24 (1): 95. Jan. 1977. SFA 22(2)

76-000686 Jensen, L. A. /PARABOTHRIOCEPHALUS SAGITTICEPS/ (SLEGGS 1927) COMB. N. (CESTODA: PARABOTHRIOCEPHALIDAE) FROM /SEBASTES PAUCISPINIS/ OF SOUTHERN AND CENTRAL CALIFORNIA. J. Parasitol. 62 (4): 560-562. Aug. 1976. SFA 22(2)
[17639 Clymer St., Granada Hills, CA 91344] /Parabothriocephalus sagitticeps/ (Sleggs 1927) from /Sebastes paucispinis/ is redescribed and given a generic reassignment. The new combination is based on the dorsal, submarginal genital atrium and testes arrangement. The tapeworm prevalence was 84 percent of 354 rockfish in the coastal water of Southern and Central Calfornia.

76-000687 Korting, W. LARVAL DEVELOPMENT OF /BOTHRIOCEPHALUS/ SP. (CESTODA: PSEUDOPHYLLIDEA) FROM CARP (/CYPRINUS CARPIO/ L.) IN GERMANY. J. Fish Biol. 7 (6): 727-733. Nov. 1975. SFA 22(2)
[Inst. Zool. Parasitol., Vet. Fac., Univ. Munich, West Germany] Life cycle experiments with the tapeworm /Bothriocephalus/ sp. from carp were carried out using /Cyclops abyssorum/ Sars as the intermediate host. The eggs expelled from gravid segments were embryonated but not fully developed. Hatching of the coracidia occurred by the third day. Procercoid development was completed after 8-10 days. Comparing the results and descriptions of previous authors, it is suggested that the cestode belong to /bothriocephalus acheilognathi/ Yamaguti, 1934 according to the priority of name.

76-000688 MacKenzie, K. /RENICOLA/ METACERCARIAE (DIGENEA: RENICOLIDAE) IN CLUPEOID FISH: NEW HOST RECORDS. J. Fish Biol. 7 (3) : 359-360. May 1975. SFA 22(2)

[Mar. Lab., Dep. Agric. Fish., Aberdeen AB9 8DB, Scotland] Two distinct types of /Renicola/ metacercariae were found in herring, /Clupea harengus/ L., from Scotish waters, and one in anchovies, /Engraulis encrasicholus/ (L.), from the central North Sea. Both constitute new host records. These parasites may prove to be of value as biological tags for herring and other clupeoid fish.

76-000689 MacKenzie, K. SOME ASPECTS OF THE BIOLOGY OF THE PLEROCERCOID OF /GILQUINIA SQUALI/ FABRICIUS 1794 (CESTODA: TRYPANORHYNCHA). J. Fish Biol. 7 (3): 321-327. May 1975. SFA 22(2)

[Mar. Lab., Dep. Agric. Fish., Aberdeen AB9 8DB, Scotland] The eyes of more than 24,000 northern North Sea whiting were examined for infection with /Gilquinia squali/ plerocercoids. Infection, which is apparently non-seasonal, begins when the fish are aged 1+, builds up to a peak at 2+ to 4+, and decreases thereafter. The intensity of infection ranged from 1-18 plerocercoids per fish. Evidence is presented of the development of immunity in whiting to /G. squali/, and observations on the parasite's eggs suggests that they are not randomly distributed but tend to aggregate. One or both of these features could give rise to the negative binomial type of frequency distribution observed. The frequency of left eye infection was consistently greater than that of right eye.

76-000690 Markewitch, A. P. PARASITIC COPEPODS ON THE FISHES OF THE USSR. Izdat. Akad. Nauk Ukrain. SSR, Kiev 445p. 1956. Available as English Translation TT 70-53090, U.S. Dep. Commerce, Natl. Tech. Info. Serv., Springfield, VA 22161. SFA 22(2)

[Dep. Zool., USSR Acad. Sci., Kiev, USSR] Although belated, this translation of a 1956 paper will be helpful to those who have difficulty in obtaining Russian literature. It is in two parts: Part I concerns the morphology, development, biology, economic importance and pathology. Part II contains descriptions of all the Russian species known in 1956. There are identification keys and the illustrations include drawings of the intact parasites and details of the appendages useful in identification of the species.--G. L. Hoffman.

76-000691 Matsudo, H.; Chamberlain, D. W. NOTES ON MYCOPLASMA-LIKE ORGANISMS IN SKIN TUMORS OF DOVER SOLE, /MICROSTOMUS PACIFICUS/, TAKEN NEAR SEWAGE OUTFALLS. Bull. South. Calif. Acad. Sci. 75 (3): 270-273. 20 Nov. 1976. SFA 22(2)

[Ultrastructural Res. Lab., Saint Joseph Med. Cent., Burbank, CA 91505] Electron microscopical observations of skin tumors of Dover sole, /Microstomus pacificus/, taken near sewage outfalls at Santa Monica Bay, Newport Beach, and Port Hueneme, California reveal mycoplasma-like organisms in all tumors (nine) of the five specimens. Since a mycoplasma, /Acholeplasma laidlawii/, has been isolated from sewage, the presence of mycoplasma-like organisms (if indeed they are mycoplasmas) in the skin tumors of /M. pacificus/ suggests that sewer effluent may be a possible source.

76-000692 Meakins, R. H.; Walkey, M. THE EFFECTS OF PARASITISM BY THE PLEROCERCOID OF /SCHISTOCEPHALUS SOLIDUS/ MULLER 1776 (PSEUDOPHYLLIDEA) ON THE RESPIRATION OF THE THREE-SPINED STICKLEBACK /GASTEROSTEUS ACULEATUS/ L. J. Fish Biol. 7 (6): 817-824. Nov. 1975. SFA 22(2)

[Dep. Zool., Dar es Salaam, Tanzania] Rates of oxygen consumption by parasitized and unparasitized sticklebacks were recorded at three levels of activity in February and August. Negative correlations were demonstrated between specific respiratory rates and fish body weights. At routine and maximum activity, infected fish consumed more oxygen than uninfected fish. At minimum activity levels no significant differences in respiration rates were detected. Seasonal variation in respiration rates was attributed to acclimation. Difficulties of determining specific respiration rates for parasitized organisms are discussed and attempts are made to assess the physiological basis of the respiratory and behavioural characteristics of infected fish.

76-000693 Peters, G. SEASONAL FLUCTUATIONS IN THE INCIDENCE OF EPIDERMAL PAPILLOMAS OF THE EUROPEAN EEL /ANGUILLA ANGUILLA/ L. J. Fish Biol. 7 (4): 415-422. July 1975. SFA 22(2)

[Inst. Hydrobiol. Fischereiwiss., Univ. Hamburg, 2 Hamburg 50, Olbersweg 24, West Germany] The eels of the Lower Elbe (15-35 cm total length, freshwater age groups III-V) show a high incidence of epidermal papillomas. These neoplasms, situated mainly in the snout region, show a marked seasonal fluctuation. The incidence is low in spring and autumn (min. 2-3 percent) and rises sharply in summer (max. 28 percent). The size of the papillomas is also smaller during the colder seasons of the year (up to 300 mm^3) reaching a maximum in August/September (up to 900 mm^3). The increase in growth of the tumours follows the rise in frequency with a delay of 3-4 weeks. These seasonal fluctuations of tumour growth are possibly related to the alteration of the water temperature and oxygen content.

76-000694 Rawson, M. V., Jr. POPULATION BIOLOGY OF PARASITES OF STRIPED MULLET, /MUGIL CEPHALUS/ L. I. MONOGENEA. J. Fish Biol. 9 (2): 185-194. Aug. 1976. SFA 22(2)

[Coop. Ext. Serv., Univ. Ga., Athens 30601] Young-of-the-year (class 0) and yearling (class 1) striped mullet, /Mugel cephalus/, were collected from Sapelo Island, Georgia from May 1970 to June 1971 to study the development, seasonal abundance and relationship of environmental variables to parasitic populations. The number of species of parasites increased with age of the host. Initial infection appeared to be influenced by closeness of association of mullet age classes, by the period of abundance of a parasite on class 1 mullet and by the mobility of the infective parasitic stage. Fluctuations in intensity and prevalence of a parasite on class 0 mullet were similar to those of class 1 mullet after the initial infection. /Ancyrocephalus vanbenedenii/ was first observed on class 0 mullet in March. Intensity was high on both classes in spring and on reproductively active mullet in late autumn. Prevalence on both classes was above 80 percent except in late summer. /Polyclithrum mugilis/ was not observed on class 0 mullet until August even though intensity and prevalence on class 1 mullet was highest during early spring. /Gyrodactylus mugelus/ did not occur on class 0 mullet but appeared on class 1 mullet during late summer. /Microcotyle psuedomugilis/ was observed on class 0 mullet in early summer and /Metamicrocotyla macracantha/ in October. Both species occurred but at a low intensity on class 1 mullet.

76-000695 Rumpus, A. E. THE HELMINTH PARASITES OF THE BULLHEAD /COTTUS GOBIO/ (L.) AND THE STONE LOACH /NOEMACHEILUS BARBATULUS/ (L.) FROM THE RIVER AVON, HAMPSHIRE. J. Fish Biol. 7 (4): 469-483. July 1975. SFA 22(2)

[Dep. Life Sci., Polytech. Central London, 115 New Cavendish St., London W1M 8JS, England] Specimens of /Cottus gobio/ and /Noemacheilus barbatulus/ from the River Avon, Hampshire, were examined between July 1970 and July 1971. Both fish were found to act as hosts for /Nicolla gallica/ (adult), /Pomphorhynchus laevis/ (adult) and /Triaenophorus nodulosus (plerocercoid). The incidence and intensity of infection were lower in /N. barbatulus/ than in /C. gobio/, and this was related to differences in host diet. A small number of /N. barbatulus/ were also found to harbour /Proteocephalus torulosus/. Seasonal cycles of incidence and intensity were evident in /N.gallica/, with a peak occurring in the winter. /P. laevis/ and /T. nodulosus/ showed no such cycles. Increasing host size was associated with a higher infection of both /N. gallica/ and /P. laevis/, But not /T. nodulosus/. The diet of the host was considered to be important in influencing this increase. Differences in host reproductive condition affected the population levels of /N. gallica/ only, where an increased parasite burden was evident in gravid female fish. This was considered to influence the observed increase in incidence and intensity of this parasite during the winter. None of the parasites showed any seasonal maturation cycles. There was no evidence of any interactions between the parasite populations. Host diet and the availability of infective larvae were considered to be the most important features influencing the number of parasites which became established, and the rate at which this occurred. Temperature probably acted indirectly on the establishment of /N. gallica/, by controlling the availability of the larval stages, and also, by influencing the host reproductive condition, on the length of time for which the parasite was retained by the host.

76-000696 Schell, S. C. THE LIFE HISTORY OF /NEZPERCELLA LEWISI/ SCHELL 1974 (TREMATODA: OPECOELIDAE), A PARASITE OF THE NORTHERN SQUAWFISH, AND THE SMALLMOUTH BASS. J. Parasitol. 62 (6): 894-898. Dec. 1976. SFA 22(2)

[Dep. Biol. Sci., Univ. Idaho, Moscow 83843] /Nezpercella lewisi/ is an intestinal parasite of /Ptychocheilus oregonensis/ and /Micropterus dolomieui/ in Idaho. The miracidium develops and hatches within 12 to 14 days at 22 to 26 C or within 50 to 60 days at 12 to 15 C. Cotylomicrocercous cercariae develop in daughter sporacysts in /Lithoglyphus verens/ and encyst in fry of /Richardsonius balteatus/, /Rhinichthys cataractae/, /R. osculus/, /Ptychocheilus oregonensis/, /Cottus rhotheus/, and /Salmo gairdneri/. Natural infections with metacercariae were found in all of the above fishes except speckled dace and trout. Squawfish were fed fry of experimentally infected redside shiner and squawfish and partially developed specimens of /N. lewisi/ recovered 8 weeks later. The larval stages are like those of trematodes in the family Opecoelidae to which the species is transferred.

76-000697 Sweeting, R. A. STUDIES ON /LIGULA INTESTINALIS/ (L.) EFFECTS ON A ROACH POPULATION IN A GRAVEL PIT. J. Fish Biol. 9 (6): 515-522. Dec. 1976. SFA 22(2)

[Thames Conservancy Div., Thames Water Authority, Nugent House, Vastern Rd., Reading RG1 8DB, England] the effects of the plerocercoids of /Ligula intestinalis/ were studied on a population of roach, /Rutilus rutilus/ in a gravel pit. The incidence of the cestode fell from 92 percent in 0+ roach in April to 25 percent in January of the succeeding year. The fall in the number of parasitized fish was

76-000697 CONTINUED
due to predation, mainly by pike, /Esox lucius/. Observations indicated most of the parasitized fish failed to become sexually mature although the actual growth rate of the fish was not markedly reduced. The plerocercoids of /L. intestinalis/ grew more rapidly during the summer. The author recommends roach of less than 9 months of age should not be introduced into confined water such as a gravel pit, since after this period they appear to be much less likely to be parasitized.

76-000698 Tallman, C. J.; Ritter, E. /CORALLOTAENIA MINUTIA/ (FREZE 1965) (CESTODA: PROTEOCEPHALIDEA) FROM BROWN BULLHEAD FROM WESTERN NEW YORK. J. Parasitol. 62 (6): 864. Dec. 1976. SFA 22(2)
[Dep. Math/Sci., Genessee Community Coll., Batavia, NY]

76-000699 Vaughan, G. E.; Coble, D. W. SUBLETHAL EFFECTS OF THREE ECTOPARASITES ON FISH. J. Fish Biol. 7 (3): 283-294. May 1975. SFA 22(2)
[Iowa Conserv. Comm., Big Spring Fish Hatchery, Elkader 52043]
Vulnerability to predation, resistance to high temperature, weight-length relationships, and fecundity were compared for fish with and without or with light and heavy infestations of three ectoparasites. The fish and parasites were fathead minnow (/Pimephales promelas/) with anchor worm (/Lernaea cyprinaceae/); brook trout (/Salvelinus fontinalis/) with gill lice (/Salmincola edwardsii/); and yellow perch (/Perca flavescens/) with black-spot (/Neascus/ of /Crassiphiala bulboglossa/). The only sublethal effect found was that of gill lice, which reduced resistance of brook trout to high temperature. None of the three ectoparasites increased vulnerability of fish to predation by piscivorous fish.

76-000700 Weber, D. D.; Schiewe, M. H. MORPHOLOGY AND FUNCTION OF THE LATERAL LINE OF JUVENILE STEELHEAD TROUT IN RELATION TO GAS-BUBBLE DISEASE. J. Fish Biol. 9 (3): 217-233. Sept. 1976. SFA 22(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] General morphology of the lateral line of juvenile steelhead trout, /Salmo gairdneri/, is described. Through electrophysiological monitoring of individual nerve fibres, control patterns for spontaneous activity and reaction to sensory receptor stimulation were established. Spontaneous activity has a positive correlation with temperature and number of receptors innervated. Presence of directional sensitivity and response to near field water displacement at different frequencies is similar to that found in other fishes and amphibians. Normal lateral line response to a standardized set of stimuli was compared with the response of fish affected by gas-bubble disease. Results show that as gas emboli formed in the scale pockets of the trunk lateral line of stressed fish, the ability to respond to stimuli was either diminished or completely disappeared. Further testing demonstrated that this sensory loss was reversible and that upon return to equilibrated water gas emboli disappeared and normal function was regained. This sublethal effect of gas-bubble disease on the lateral line sensory system may be an important element contributing to indirect mortality.

POLLUTION

76-000701 Alden, R. W. III GROWTH, REPRODUCTION AND SURVIVAL OF SOME MARINE COPEPODS SUBJECTED TO THERMAL AND MECHANICAL STRESS. Ph. D. dissertation, Univ. Fla. 352p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

A study was made of the lethal and sublethal effects of power plant entrainment and thermal stress on the copepods of the Crystal River estuary on the west coast of Florida. Temperature, salinity, and temperature-salinity interactions were seen to be among the most important factors influencing mortality. Under conditions of low temperature and moderate salinities, mechanical damage was the major lethal entrainment effect for most species, but produced relatively low mortalities compared to those found with other temperature-salinity regimes. Each species had unique response patterns to temperature-salinity effects, as well as to combinations of other variables, but virtually all exhibited rapidly increasing mortalities as temperatures rose above 35°C. Sublethal entrainment effects were negligible until summer conditions caused discharge waters to rise above 35°C. Above this temperature, fecundity rates declined and growth rates of juveniles dropped below those of control populations. Long-term mortality rates of copepods surviving entrainment were not significantly different from those of controls, although the mortality rates of both populations were shown to be accelerated by increasing culture temperatures. Possible biological and ecological implications of entrainment and thermal stress are discussed in light of the findings of the present study.--From abstr.

76-000702 Brugam, R. B. THE HUMAN DISTURBANCE HISTORY OF LINSLEY POND, NORTH BRANFORD, CONNECTICUT. Ph. D. dissertation, Yale Univ. 196p. 1975. From Diss. Abstr. Int. B Sci. Eng. 36(11), 1976. SFA 22(2)

The reconstruction of the history of the lake was carried out using fossil remains and chemical analyses from a 283 cm. long sediment core from the deep water of the lake, which spanned the time period from 1100 A.D. to the present. In pre-settlement times Linsley Pond was probably mesotrophic to moderately eutrophic. The arrival of the English colonists in 1700 changed the lake in minor ways. Their deforestation of the landscape increased the flow of nutrients to the lake, causing a small increase in primary productivity which is indicated by an increase in the influx of diatom frustules to the sediment. Certain sensitive diatom species became extinct at this time. There was an increase in mineral matter influx to the sediment indicating increased soil erosion. The next major change occurred in 1810 when the Linsley family constructed a house and barn on the shore of the lake. This caused an increase in /Melosira ambigua/. Such a change is probably indicative of increasing primary productivity due to intensifying land use and to inputs of household and barnyard refuse into the lake. The biggest change in the lake community came in 1915, when the diatom flora of the lake changed toward highly eutrophic species. These changes all indicate that the lake had become more eutrophic, with higher nutrient inputs and a more anaerobic hypolimnion. It is likely that these changes resulted from a change in land use at the Linsley farm. The final change in the lake's status occurred in 1960 when the watershed was turned into housing subdivisions. This caused dramatic increases in soil erosion. The zooplankton community changed for the first time with the appearance of /Daphnia ambigua/ in the lake.--From abstr.

76-000703 Burton, D. T.; Margrey, S. L.; Richardson, L. B. EFFECTS OF POWER-PLANT ENTRAINMENT TEMPERATURES ON OXYGEN CONSUMPTION PATTERNS OF AMPHIPODS AND GRASS SHRIMP. IN G. W. Esch and R. W. McFarlane, eds. Thermal Ecology II. U.S. Energy Res. Dev. Admin. Symp. Ser. 40 (CONF-750-425). Natl. Tech. Info Serv., Springfield, VA. 93-99. 1976. SFA 22(2)

[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD]

76-000704 Cherko, I.; Harrow, L.; Schlesingler, A. LONG TERM EXPOSURE TO EFFLUENTS OF THE FORT CALHOUN NUCLEAR POWER STATION: EFFECTS UPON SURVIVAL AND DEVELOPMENT OF AGE 0 /ICTALURUS PUNCTATUS/. Proc. Nebr. Acad. Sci. Affil. Soc. 86: 11. 1976. Abstract only. SFA 22(2)

[Omaha Public Power Dist., Omaha, NE 68102] This study was undertaken in compliance with Technical Specifications of the Fort Calhoun Nuclear Power Station, one of which requires that an assessment be made of techniques for studying plant impacts during life cycles of fish. To evaluate the feasibility of studying the long-term exposure of fish, a floating box was designed to follow fluctuations in river stage. /Ictalurus punctatus/ was selected as a chacteristic river fish with commercial and recreational significance. Hatchery raised young-of-the-year fish (3 to 5 inch) were randomly divided into groups; an upstream (U) population of 53 and downstream (D) of 50. These weighed and measured fish were placed in the live boxes on August 6, 1975. The fish were observed once each work day (Mon-Fri) and food (Purina Catfish Chow) was provided as needed. The fish were weighed and measured at 2 week intervals. At the termination date, November 10, 1975, there were 28 U survivors and 22 D survivors. All fish were sacrificed, weighed, measured and studied for parasite load and general body condition. At termination the mean weight of U (21.2 g) was significantly lower than D (35.1 g). The mean length for U (11.0 cm) was significantly shorter than D (12.8 cm). The floating live box technique for long-term exposure studies in the Missouri River is sufficiently promising to merit continued effort.--From abstr.

76-000705 Clark, R. C., Jr. IMPACT OF THE TRANSPORTATION OF PETROLEUM ON THE WATERS OF THE NORTHEASTERN PACIFIC OCEAN. Mar. Fish. Rev. 38 (11): 20-26. Nov. 1976. SFA 22(2)

[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000706 Collins, J.; Tenney, R. D. FISHERY WASTE EFFLUENTS: A METHOD TO DETERMINE RELATIONSHIPS BETWEEN CHEMICAL OXYGEN DEMAND AND RESIDUE. NOAA Fish. Bull. 74 (4): 725-731. Oct. 1976. SFA 22(2)

[NMFS, P.O. Box 1638, Kodiak, AK 99615] Researchers and the fishing industry have experienced difficulty in applying the Environmental Protection Agency's standard tests to industrial fishing waste effluents, espcially for total suspended and settleable solids, and oil and grease. The relationship between chemical oxygen demand and residue was determined on a limited number of samples from four types of screened waste effluents from November 1973 to September 1974: shrimp using fresh or salt water processing, snow crab, and canned salmon. In addition to chemical oxygen demand and residue, tests for settleable solids, total suspended and settleable solids, oil and grease, protein, and salt were also performed. Based on these relationships, a method is suggested to develop a system for the analysis of pollutants that will be more economic and give more meaningful data than currently obtainable under Environmental

76-000706 CONTINUED
Protection Agency's methods. The method requires that base data on a plant be obtained to relate chemical oxygen demand with residue values using regression lines and equations. A subsequent routine monitoring program need only test for total residue and chemical oxygen demand of the filterable residue. Substitution into the equations gives the other residue fractions and their chemical oxygen demand values, i.e., total chemical oxygen demand, chemical oxygen demand of the particulate matter, filterable residue, and nonfilterable residue.

76-000707 Craddock, D. R. IMPACT OF COOLING WATERS ON THE AQUATIC RESOURCES OF THE PACIFIC NORTHWEST. Mar. Fish. Rev. 38 (11): 27-34. Nov. 1976. SFA 22(2)
[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000708 Hall, A. S.; Teeny, F. M.; Gauglitz, E. J., Jr. MERCURY IN FISH AND SHELLFISH OF THE NORTHEAST PACIFIC. II. SABLEFISH, /ANOPLOPOMA FIMBRIA/. NOAA Fish. Bull. 74 (4): 791-797. Oct. 1976. SFA 22(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Sablefish, /Anoplopoma fimbria/, collected from several locations in Alaska, Washington, Oregon, and California were analyzed for their mercury content. Mean mercury level in this species varied with the geographical location of catch, showing a gradual increase in magnitude from north to south; the average size of the specimens decreased in the same pattern, north to south. Of the 692 specimens analyzed in this study, approximately 30 percent exceeded the U.S. Food and Drug Administration action level of 0.50 ppm mercury. Significant relationships between the size of the fish and mercury content were observed.

76-000709 Hall, A. S.; Teeny, F. M.; Lewis, L. G.; Hardman, W. H.; Gauglitz, E. J., Jr. MERCURY IN FISH AND SHELLFISH OF THE NORTHEAST PACIFIC. I. PACIFIC HALIBUT, /HIPPOGLOSSUS STENOLEPIS/. NOAA Fish. Bull. 74 (4): 783-789. Oct. 1976. SFA 22(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] A total of 1,227 Pacific halibut, /Hippoglossus stenolepis/, were analyzed for mercury content in the edible muscle tissue. These fish were obtained from five geographical areas within the species range: the Bering Sea, Gulf of Alaska, southeast Alaska, British Columbia, and Washington-Oregon. Mercury was found to be uniformly distributed from nape to tail in the edible muscle tissue. Within each geographical area the mercury concentration increased as the size of the fish increased. The mercury concentration also increased in fish of the same size from the northern to the southern part of the species range.

76-000710 Jaworski, E.; Raphael, C. N. THE CONFINED DISPOSAL PROGRAM FOR POLLUTED DREDGED SPOIL IN THE GREAT LAKES. Coast. Zone Manage. J. (Copywrite Crane, Russak & Co., N.Y.) 3 (1): 91-96. 1976. SFA 22(2)
[Dep. Geog. Geol., East. Mich. Univ., Ypsilanti] Delay in the construction of containment sites is allowing time for significant adjustments in the confined disposal program of the Great Lakes. Through modification of the pollution criteria and improvements in harbor sampling, fewer containment sites, some with smaller capacities, are now required. Perhaps most important, the delays are providing additional time for upgrading waste treatment facilities which may be reducing future dredging volumes. Unless pollution abatement measures are implemented and technological improvements made

76-000710 CONTINUED
regarding containment of the excess spoil water, cleanup of the harbors and connecting channels may not be fully accomplished during the 10-year period in which containment sites are authorized.

76-000711 Karrick, N. L.; Gruger, E. H., Jr. POLLUTION IN THE NORTHEAST PACIFIC OCEAN. Mar. Fish. Rev. 38 (11): 2-19. Nov. 1976. SFA 22(2)
[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000712 Livingston, R. J. IMPACT OF KRAFT PULP-MILL EFFLUENTS ON ESTUARINE AND COASTAL FISHES IN APALACHEE BAY, FLORIDA, USA. Mar. Biol. 32 (1): 19-48. 22 Sept. 1975. SFA 22(2)
[Dep. Biol. Sci., Fla. State Univ., Tallahassee] Offshore areas that received kraft-mill effluents (KME) displayed significant increases in color and turbidity and reductions in (benthic) dissolved oxygen compared to a nearby control area. Estuarine and marsh fish assemblages in areas of acute impact were severly reduced in terms of numbers of individuals (/N/) and species (/S/). Offshore areas exposed to varying (chronic) levels of KME were characterized by complex interactions that included seasonal variations of impact. A broad offshore area showed reductions in numbers of individuals and species taken per month. However, the cumulative (annual) number of species taken was the same for polluted and unpolluted (control) areas due to a recruitment of relatively rare species in the areas of impact. Such polluted areas showed decreased dominance as well as qualitative differences in species composition compared to control areas. Inshore bay stations that were most severely affected by KME were dominated by the bay anchovy, /Anchoa mitchilli/. While species richness and species diversity were lower at the highly stressed stations, in other outlying areas of moderate impact (reduced N and S) there were no reductions of such parameters compared to control areas. Thus, species diversity was not an indicator of pollution /per se/, and was useful only when taken in conjunction with various other parameters. In general, the effect of KME on offshore fish assemblages appeared to be due to a complex combination of habitat alteration, reduced benthic productivity, and individual behavioral reactions. Kraft pulp-mill effluents had a pronounced effect on the benthic standing crop of plants and animals, but that intensive sampling over prolonged periods of time was necessary for an adequate assessment of the problem.--From abstr.

76-000713 Reutter, J. M.; Herdendorf, C. E. THERMAL DISCHARGE FROM A NUCLEAR POWER PLANT: PREDICTED EFFECTS ON LAKE ERIE FISH. Ohio J. Sci. 76 (1): 39-45. Jan. 1976. SFA 22(2)
[Cent. Lake Erie Area Res., Ohio State Univ., Columbus 43210] The Davis-Besse Nuclear Power Station, currently under construction on the south shore of Lake Erie near Locust Point, will use water from the lake for cooling purposes. Based on thermal specifications for this plant, we conducted laboratory experiments to try to predict the effects of thermal effluents on the Lake Erie fishery resource. Over 2000 fish representing 24 of the 47 local species were tested to determine their seasonal final temperature preferenda. All final preferenda were above lake temperature during fall, winter, and spring indicating attraction to thermal discharges during these seasons. Summer final preferenda were approximately equal to or slightly higher than lake temperature for all species tested indicating indifference or slight attraction to thermal plumes. Heat shock tests were conducted on 852 fish of 33 species and cold shock tests were conducted on 443 fish of 22 species. Heat and cold shock results

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indicated that the absolute temperature to which fish were subjected was more important than the size of the temperature change. Therefore, summer heat shocks and winter cold shocks caused the greatest stress. The species most likely to be harmed by thermal effluents were /Alosa pseudoharengus/ (alewife), /Aplodinotus grunniens/ (freshwater drum), /Dorosoma cepedianum/ (gizzard shad), and /Morone chrysops/ (white bass).

76-000714 Scott, J. S. BACK-CALCULATED FISH LENGTHS AND HG AND ZN LEVELS FROM RECENT AND 100-YR-OLD CLEITHRUM BONES FROM ATLANTIC COD (/GADUS MORHUA/). J. Fish. Res. Board Can. 34 (1): 147-150. Jan. 1977. In English with French summ. SFA 22(2)
[Dep. Environ., Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Dimensions of cleithrum bones from recently caught Atlantic cod (/Gadus morhua/) were measured and plotted against observed fish lengths to back-calculate cod lengths from cleithra from a ship wrecked in 1865. Mercury levels in the historical bones were approximately the same as those in recent material and showed no increase with fish length, but zinc levels appear to have increased since 1865 and increased with fish length.

76-000715 Spacie, A. THE BIOCONCENTRATION OF TRIFLURALIN FROM A MANUFACTURING EFFLUENT BY FISH IN THE WABASH RIVER. Ph. D. dissertation, Purdue Univ. 149p. 1975. From Diss. Abstr. Int. B Sci. Eng. 36(9), 1976. SFA 22(2)
Trifluralin, a nitroaniline herbicide, was discharged into the Wabash River from a manufacturing facility near Lafayette, Indiana. Although the wastewater from the synthesis of trifluralin was treated extensively, trace amounts were still present in the final effluent. River fish exposed to the effluent accumulated trifluralin in fatty tissue. On July 15, 1974. activated carbon filtration was installed to remove trifluralin from the wastewater. Residues in sauger and redhorse declined 40 to 83 percent form August to September, 1974, as a result of the improved treatment. Bioconcentration factors (ppm in whole fish/ppm in water) for trifluralin estimated from the field data were: sauger, 5421; shorthead redhorse, 2832; golden redhorse, 1689. A bioconcentration factor of 3261 was calculated for fathead minnows (/Pimephales promelas/) based on the ratio of uptake rate to clearance rate obtained from a laboratory exposure. No accute effects of trifluralin were observed in Wabash River fish.--From Abstr.

76-000716 Wrenn, W. B. FISHERIES STUDIES IN RELATION TO A LONG HEATED DISCHARGE CHANNEL (COLBERT STEAM PLANT, TENNESSEE RIVER). Ph. D. dissertation, Va. Polytech. Inst. & State Univ. 120p. 1974. From Diss. Abstr. Int. B Sci. Eng. 36(1), 1975. SFA 22(2)
Cooling water for Colbert Steam Plant, located in northwest Alabama, is pumped from the Tennessee River, heated about 8 C, and discharged into the lower 4.5 km of Cane Creek which flows into the Tennessee River about 1.6 km below the plant. The heated effluent comprises approximately 98 percent of the creek flow. Maximum temperatures in the discharge channel approach 36C in summer and 15C in winter; ambient temperatures of the Tennessee River normally range from 4 to 31C. No direct mortalities resulting from temperature differences were observed. Species diversity was inversely related to temperature in the discharge channel (P less than 0.05) but the Shannon index bar h was not temperature dependent. Normal summer effluent temperatures (33-35C) did not create a thermal barrier with reference to the movement of /Micropterus dolomieui/, /M. salmoides/, or /Pylodictus olivaris/ in lower Cane Creek. /Pylodictus olivaris/ frequently selected temperatures above 30C. The single /Stizostedion vitreum/

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tagged remained in the heated discharge 30 days during which time the effluent temperature increased from 19.2 to 27.4C. /Dorosoma/ spp. and /Aplodinotus grunniens/ comprised approximately 90 percent and six percent, respectively, of the larval fish entrained by this plant which normally uses about three percent of the total riverflow for condenser cooling. Peak density (1.5/m^3) occurred during June.--From abstr.

FISH KILLS

76-000717 Moore, R. H. OBSERVATIONS ON FISHES KILLED BY COLD AT PORT ARANSAS, TEXAS, 11-12 JANUARY 1973. Southwest. Nat. 20 (4): 461-466. 10 Jan. 1976. SFA 22(2)
[Dep. Biol., Univ. S. Car., Conway 29526] The effects of a cold front, which decreased water temperatures to freezing, on estuarine fish near Redfish Bay and Port Aransas, Texas are noted. Most Texas estuarine fish appear able to tolerate 6-7 C; torpidity and death occur below this level. A few species, notably the pinfish, /Lagodon rhomboides/, and the spotted sea trout, /Cynoscion nebulosus/, can tolerate lower temperatures.

TOXICOLOGY; BIOASSAYS

76-000718 Abel, P. D. TOXIC ACTION OF SEVERAL LETHAL CONCENTRATIONS OF AN ANIONIC DETERGENT ON THE GILLS OF THE BROWN TROUT (/SALMO TRUTTA/ L.). J. Fish Biol. 9 (5): 441-446. Nov. 1976. SFA 22(2)
[Dep. Biol., Sunderland Polytech., Chester Rd., Sunderland SR1 3SD, England] The pathological effects of ten lethal concentrations of the anionic detergent, sodium lauryl sulphate, on the gills of /Salmo trutta/ L. have been studied by light and electron microscopy. At concentrations to 120 mg/l (medium survival times greater than 1 h), epithelial cell death is associated with lysosome formation. Acute inflammation of the gill tissue, extensive detachment of the epithelium and, except at the lowest concentrations, collapse of the pillar cell system occur. At concentrations above 120 mg/l (medium survival times less than 1 h) very rapid lysis of cells results in the complete disruption of cellular and tissue structure. Changes in the gross structure of the gills are explainable in terms of the rate and nature of toxic action at the cellular level. Review of the biomedical literature suggests the observed effects of sodium lauryl sulphate on gill cells correspond to the two mechanisms by which detergents cause death in isolated cells. These are autolysis, i.e. lysis by the action of the cell's own enzymes, induced by an initial lesion in the cell membrane whose precise nature is not known; and rapid lysis by the direct action of the detergent on the cell constituents.

76-000719 Addison, R. F.; Zinck, M. E. RATE OF CONVERSION OF ^{14}C-P,P'-DDT TO P,P'-DDE BY BROOK TROUT (/SALVELINUS FONTINALIS/): ABSENCE OF EFFECT OF PRETREATMENT OF FISH WITH COMPOUNDS RELATED TO P,P'-DDT. J. Fish. Res. Board Can. 34 (1): 119-122. Jan. 1977. In English with French summ. SFA 22(2)
[Dep. Environ., Fish. Mar. Serv., Mar. Ecol. Lab., Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada] Brook trout (/Salvelinus fontinalis/) fingerlings were given four injections at weekly intervals of either p,p'-DDT, p,p'-DDD, or p,p'-DDMU to yield tissue concentrations of 105 mg/kg wet wt. The effect of these treatments on

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the subsequent dehydrochlorination of an injection of ^{14}C-p,p'-DDT was investigated. The rate of dehydrochlorination of ^{14}C-p,p'-DDT by the trout was not influenced by these treatments and was more highly correlated with factors such as the weight of the fish and their lipid content. Of the compounds injected during the treatment of the fish, p,p'-DDMU was cleared more rapidly than the others.

76-000720 Bimber, D. L.; Boenig, R. W.; Sharma, M. L. RESPIRATORY STRESS IN YELLOW PERCH INDUCED BY SUBTOXIC CONCENTRATIONS OF DIQUAT. Ohio J. Sci. 76 (2): 87-90. Mar. 1976. SFA 22(2)
[Dep. Biol., State Univ. Coll., Freedonia, NY 14063] Two-year-old yellow perch (/Perca flavescens/) from Chautauqua Lake in western New York State were examined using short-term static bioassay techniques to determine possible deleterious subtoxic effects of Diquat, an aquatic herbicide commonly used in the lake. Under laboratory conditions, a significant level of respiratory stress was suffered by fish at Diquat concentrations similar to those applied to the lake during weed control measures and at concentrations significantly lower than those causing death (1 to 5 ppm).--From abstr.

76-000721 Brafield, A. E.; Matthiessen, P. OXYGEN CONSUMPTION BY STICKLBACKS (/GASTEROSTEUS ACULEATUS/ L.) EXPOSED TO ZINC. J. Fish Biol. 9 (4): 359-370. Oct. 1976. SFA 22(2)
[Dep. Biol., Queen Elizabeth Coll., Univ. London, Campden Hill Rd., London W8 7AH, England] The rate of oxygen consumption by sticklebacks has been studied by long-term continuous-flow respirometry. Exposure to 1 p.p.m. zinc in calcium-free water causes wide variations in individual responses, but oxygen uptake tends to rise and then become extremely erratic, before declining as death approaches. Behavioural abnormalities such as increased ventilation rate, loss of balance, and long periods of inactivity alternating with spasmodic swimming also occur. Exposure to 6.5 p.p.m. zinc in high-calcium water generally causes a rise in oxygen comsumption, followed by fluctuations in the rate of uptake, but no behavioural abnormalities occur and deaths are rare even after exposure for 400 h. If restored to zinc-free water after 40 h exposure to zinc, recovery is generally complete, although fluctuating rates of oxygen uptake persist. These results are discussed in relation to previous work on the effects of heavy metals on fish respiration.

76-000722 Bronage, N. R.; Fuchs, A. A HISTOLOGICAL STUDY OF THE RESPONSE OF THE INTERRENAL CELLS OF THE GOLDFISH (/CARASSIUS AURATUS/) TO TREATMENT WITH SODIUM LAURYL SULPHATE. J. Fish Biol. 9 (6): 529-535. Dec. 1976. SFA 22(2)
[Dep. Biol. Sci., Univ. Aston, Gosta Green, Birmingham B4 7ET, England] Treatment of goldfish (/Carassius auratus/) with sub-lethal concentrations of an anionic detergent sodium lauryl sulphate for 1, 2 or 4 weeks produced histological changes in the interrenal (steroidogenic) cells of the head kidney which are indicative of a cellular activation. Significant increases in both the nuclear diameter of these cells and the number of nucleoli contained in the nuclei occurred after 1 week's treatment, although these effects were more pronounced after 2 and 4 weeks. There were little associated alterations in chromaffin cell activity. Preliminary experiments with another pollutant, zinc sulphate, suggest that it exerts a similar action to sodium lauryl sulphate on the interrenal cells. It is suggested the increases in corticosteroid production which occur after exposure of fish to sub-lethal concentrations of pollutants may be important in the development of a generalized disease syndrome and to the long-term success of fish populations.

76-000723 Buhler, D. R.; Stokes, R. M.; Caldwell, R. S. TISSUE ACCUMULATION AND ENZYMATIC EFFECTS OF HEXAVALENT CHROMIUM IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 34 (1): 9-18. Jan. 1977. In English with French summ. SFA 22(2)
[Dep. Agric. Chem. Environ. Health Sci. Cent., Oreg. State Univ., Corvallis 97331]

76-000724 Duursma, E. K.; Hanafi, A. USE OF PESTICIDES IN BRACKISH WATER PONDS. 1. EFFECTS OF DIAZINON ON FISH AND SHRIMP. Bull. Shrimp Cult. Res Cent. (Jepara) 1 (2): 56-68. July 1975. In English with Indonesian summ. SFA 22(2)
[UNDF/FAO, Shrimp Cult. Res. Cent., Jepara, Indonesia] Diazinon below 1 ppm can be applied for controlling chironomid larvae but shrimp in the ponds will be affected. /Chanos/ and /Tilapia/ will not be affected at the above dose. Although toxic levels may not be attained, Specimens killed by diazinon at the above concentration should not be used for human consumption.--From abstr.

76-000725 Folmar, L. C. ACROLEIN, DALAPON, DICHLOBENIL, DIQUAT, AND ENDOTHAL: BIBLIOGRAPHY OF TOXICITY TO AQUATIC ORGANISMS. U.S. Fish Wildl. Serv. Tech. Pap. 88. 16p. 1976. SFA 22(2)
[U.S. FWS, Fish pesticide Res. Unit, Federal Center, Denver, CO 80225] Toxicity tables for the herbicides acrolein, Dalapon, dichlobenil, diquat, and endothal list the test organisms, types of tests, experimental conditions, and test results. Each table is followed by a list of references, The materials provide a useful source of toxicity data on these herbicides to researchers, regulatory agencies, and manufacturers.

76-000726 Hargis, J. R. VENTILATION AND METABOLIC RATE OF YOUNG RAINBOW TROUT (/SALMO GAIRDNERI/) EXPOSED TO SUBLETHAL ENVIRONMENTAL PH. J. Exp. Zool. 196 (1): 39-44. Apr. 1976. SFA 22(2)
[Dep. Zool., Wash. State Univ., Pullman 99163] Differences between ventilatory response and metabolic rates of young rainbow trout tested within the sublethal range of pH 6 to pH 9 were observed using a flowing water respirometer. The oxygen consumption was monitored at swimming speeds of 12 cm/sec and 24 cm/sec. The oxygen consumption rates at 24 cm/sec and pH 6 (423 mg/kg-hr) and pH 9 (367 mg/kh-hr) were considerably higher than those determined near neutrality (328 mg/kg-hr). Ventilation rate increased to either side of neutrality, but significantly fewer respiratory reversals, or "coughs," were observed at pH 6 and a greater number at pH 9 than occurred at pH 7 and 8 or in untested fish. The respiratory-cough response is shown to be pH-dependent in rainbow trout and may therefore not be as reliable an indication of pollutant-caused stress in studies where the experimental pH has not been specified or controlled.

76-000727 Hewett, C. J.; Jefferies, D. F. THE ACCUMULATION OF RADIOACTIVE CAESIUM FROM WATER BY THE BROWN TROUT (/SALMO TRUTTA/) AND ITS COMPARISON WITH PLAICE AND RAYS. J. Fish Biol. 9 (6): 479-489. Dec. 1976. SFA 22(2)
[Minist. Agric. Fish. Food, Fish. Radiobiol. Lab., Lowestoft, Suffolk, England] The patterns of accumulation of caesium-137 from water by the tissues and organs of the freshwater teleost, the brown trout (/Salmo trutta/) are described. Estimates of the biological half-times and steady-state concentrations are derived, using a simple exponential equation. In all tissues and organs examined, other than

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muscle, the rate processes of the trout fall between those of the plaice and the ray. It is concluded that most of the caesium accumulated by the brown trout from water enters other than by the gut, probably through the gills, but as with plaice and ray, the main source of the caesium, possibly 90 percent, must come from the food. Despite differences in the levels of accumulation, the ratios of the tissue to blood steady state concentrations are very similar in all three species. The steady state caesium concentration of the blood appears to be directly related to the red blood cell count of the fish.

76-000728 Mackie, A. M.; Singh, H. T.; Fletcher, T. C. STUDIES ON THE CYTOLYTIC EFFECTS OF SEASTAR (/MARTHASTERIAS GLACIALIS/) SAPONINS AND SYNTHETIC SURFACTANTS IN THE PLAICE /PLEURONECTES PLATESSA/. Mar. Biol. 29 (4): 307-314. 10 Apr. 1975. SFA 22(2)
[Nat. Environ. Res. Counc., Inst. Mar. Biochem., Aberdeen, Scotland] The toxic effects of /Marthasterias glacialis/ (L.) saponins and synthetic surface-active agents were studied using the plaice /Pleuronectes platessa/ L. as test animal. Solutions of /M. glacialis/ saponins caused considerable, although non-uniform, damage to the gill epithelium, death resulting from a disturbance in the levels of oxygen, carbon dioxide, and sodium ions in the tissues and blood. Histological examination showed that solutions of the synthetic surfactants caused less damage to the gill epithelium than did the /M. glacialis/ saponins. There was a linear relationship between the logarithm of the median haemolytic concentration and the logarithm of the median lethal concentration for the synthetic surfactants. Haemolytic inhibition experiments suggest that the /M. glacialis/ saponins damage cell membranes by interacting with membrane cholesterol.

76-000729 Rand, G.; Kleerekoper, H.; Matis, J. INTERACTION OF ODOUR AND FLOW PERCEPTION AND THE EFFECTS OF PARATHION IN THE LOCOMOTOR ORIENTATION OF THE GOLDFISH /CARASSIUS AURATUS/ L. J. Fish Biol. 7 (4): 497-504. July 1975. SFA 22(2)
[Dep. Biol., Texas A&M Univ., College Station 77843] The effects were studied of a 24 h exposure to a subacute concentration of parathion (0.33 p.p.m., which is approximately equivalent to 0.5 of the 48-h LC(50)) on the locomotor orientation of mature goldfish /Carassius auratus/ L., 26-30 cm long, in response to a food odour and a water flow differential, singly and in combination, in a free choice situation. Prior to exposure, food odour alone was significantly attractive but the combination 'food odour with increased water flow', as compared with the control situation, was avoided. Factorial analysis demonstrated interaction between odour and increased flow. After exposure to parathion the food odour ceased to be attractive and was significantly avoided. This avoidance was not present in the 'food odour-increased flow' combination. The parathion exposure did not affect the response to the flow conditions /per se/ but reversed the interaction between food odour and increased flow. In addition, the exposure to the pesticide itself, in a second order interaction, interacted with 'food odour-flow' response. Hence, the short term exposure to the subacute organophospate concentration affected not only the perception of food odour and flow individually, but also the interaction between these common environmental stimuli.

76-000730 Roberts, J. R.; deFrietas, A. S. W.; Gidney, M. A. J. INFLUENCE OF LIPID POOL SIZE ON BIOACCUMULATION OF THE INSECTICIDE CHLORDANE BY NORTHERN REDHORSE SUCKERS (/MOXOSTOMA MACROLEPIDOTUM/). J. Fish. Res. Board Can. 34 (1): 89-97. Jan. 1977. In English with French summ. SFA 22(2)

[Div. Biol. Sci., Natl. Res. Counc. Can., Ottawa, ON K1A 0R6, Canada] An effect of the lipid pool size on the accumulation and clearance of /cis-/ and /trans/-chlordane by northern redhorse suckers (/Moxostoma macrolepidotum/) has been demonstrated. A technique was developed using ^{203}Hg-labeled methylmercury as a tracer, which permits the direct determination of the assimilation efficiency from food and the biological half-life of chlorinated hydrocarbons in terms of individual fish. Tissue retention of the insecticide chlordane in fish was directly proportional to the adiposity of the fish. For a fish containing 2 percent lipid, the half-life of the /cis-/isomer was 60 days and for the /trans/-isomer, 33 days. The net assimilation efficiency from food to fish tissue was also influenced by adiposity. These results on uptake and clearance, when used in a simple model for pollutant bioaccumluation, indicate that the steady state concentration of chlordane in fish will not exceed the concentration of chlordane in the diet unless the adiposity of the fish is high.

76-000731 Saward, D.; Stirling, A.; Topping, G. EXPERIMENTAL STUDIES ON THE EFFECTS OF COPPER ON A MARINE FOOD CHAIN. Mar. Biol. 29 (4): 351-361. 10 Apr. 1975. SFA 22(2)

[Mar. Lab., Aberdeen, Scotland] Effects of copper sulphate on a marine food chain were investigated in large tanks at Loch Ewe on the west coast of Scotland. The food chain consisted of phytoplankton, the bivalve /Tellina tenuis/ da Costa, and O-group plaice (/Pleuronectes platessa/ L.). During initial months after settlement, /T. tenuis/ siphons are an important food for juvenile plaice, which feed by grazing the siphon tips; these subsequently regenerate. Copper dose rates of 10, 30 and 100 ug Cu/l were investigated. Copper accumulated in sand, /T. tenuis/ flesh and shell, and plaice viscera. Accumulations were dose-dependent and in no case was a plateau concentration reached. Most of the added dose was taken up by the sand; accumulations in /T. tenuis/ shell were small--less than twice background in all cases. High levels were found in /T. tenuis/ flesh. There was no accumulation of copper in plaice muscle. Visceral accumulations after 100 days were 71, 147 and 567 ug Cu/g dry flesh for dose concentrations of 10, 30 and 100 ug Cu/l, respectively. The mean control level was 30 ug Cu/l, dry flesh. All dose concentrations reduced both the phytoplankton standing crop and the rate of photosynlthesis per unit of chlorophyll /a/. For plaice, all dose concentrations of copper resulted in reduced growth, but there was no significant change in condition or biochemical composition. The ash weight of fish exposed to copper was significantly higher than for controls.--From abstr.

76-000732 Schafer, E. W., Jr.; Marking, L. L. LONG-TERM EFFECTS OF 4-AMINOPYRIDINE EXPOSURE TO BIRDS AND FISH. J. Wildl. Manage. 39 (4): 807-811. Oct. 1975. SFA 22(2)

[U.S. FWS, Wildl. Res. Cent., Denver, CO 80225] The avian frightening agent, 4-aminopyridine (4AP), was tested on five avian and two fish species to assess the effects of long-term 4AP exposure to nontarget vertebrates. In 96-hour static tests, channel catfish (/Ictalurus punctatus/) and bluegill (/Lepomis macrochirus/) showed increasing sensitivity to 4AP with time in test waters ranging from very soft to very hard and from 12 to 22 C. The 96-hour LC(50)'s for both species ranged from 2.43 to 7.56 mg/liter (ppm). Toxicity appeared to decrease with increasing water temperatures but was

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generally unaffected by water hardness. On the basis of the data presented, the currently registered application rate for 4AP in agricultural crops (0.34 g/ha), long-term hazards to nontarget wildlife were judged to be minimal.--From abstr.

76-000733 Simonin, H. A.; Skea, J. C. TOXICITY OF DIQUAT AND CUTRINE TO FINGERLING BROWN TROUT. N.Y. Fish Game J. 24 (1): 37-45. Jan. 1977. SFA 22(2)
[N.Y. State Dep. Environ. Conserv., Albany 12201] The algicide Cutrine (7.1 per cent copper) and aquatic herbicide Diquat (35.3 per cent diquat dibromide) were tested to determine their toxicity to fingerling brown trout. When used alone, Cutrine had a 96-hour TL(m) of 0.198 milligrams of copper per liter and Diquat had a 96-hour TL(m) of 20.4 milligrams of diquat cation per liter. The data indicate that in combination the two chemicals acted synergistically. A concentration of 5.5 milligrams of diquat per liter killed only 5 per cent of the test fish after 96 hours, while a copper concentration of 0.162 milligrams per liter killed 30 percent during the same length of time. When these two concentrations were combined there was no survival after 24 hours.

76-000734 Solbe, J. F. de L. G.; Flook, V. A. STUDIES ON THE TOXICITY OF ZINC SULPHATE AND OF CADMIUM SULPHATE TO STONE LOACH /NOEMACHEILUS BARBATULUS/ (L.) IN HARD WATER. J. Fish Biol. 7 (5): 631-637. Sept. 1975. SFA 22(2)
[Water Res. Cent., Stevenage, Hertfordshire, SG1 1TH, England] The toxicity of zinc sulphate and cadmium sulphate to stone loach /Noemacheilus barbatulus/ was examined in an attempt to explain the distribution of the species in two polluted streams. Stone loach in hard water were more sensitive than rainbow trout to zinc, but much more resistant to cadmium. Their disappearance from the Willow Brook, Northants, in 1971-72 could be accounted for by zinc toxicity. A behavioural change, the loss of the instinct to hide during daylight, occurred in subsequently lethal concentrations of cadmium. The accumulation of cadmium in several tissues was also determined.

76-000735 Till, J. E. LABORATORY TECHNIQUE FOR OBTAINING FATHEAD MINNOW EGGS FOR USE IN TOXICITY EXPERIMENTS. Prog. Fish-Cult. 39 (1): 24-27. Jan. 1977. SFA 22(2)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] A laboratory technique for collecting freshly fertilized eggs of the fathead minnow (/Pimephales promelas/) has been developed for use in toxicity testing of radioactive materials or other environmental pollutants. The fathead minnow egg was selected as a test organism because the period of embryogenesis is relatively short, the number of eggs per spawning is sufficiently large to provide a test group and a control group, and the size of the parent fish is compatible with laboratory facilities. Under a controlled laboratory environment, eggs are available all year. Nesting sites were constructed by cutting plastic pipe in half and covering the inside of the pipe with a 1-mm-thick translucent polyethylene. The polyethylene with the eggs attached was removed form the shelter and cut into two pieces, each piece containing approximately the same number of eggs. One piece of polyethylene was floated in the test solution, and the other in spring water as a control. Hatching occurs in 168 h at 24°C. Toxicity of the test solution may be scored on the percentage of eggs hatching, the number of abnormal larvae produced, and larval survival.

76-000736 Weis, P.; Weis, J. S. SCHOOLING BEHAVIOR OF /MENIDIA MENIDIA/ IN THE PRESENCE OF THE INSECTICIDE SEVIN (CARBARYL). Mar. Biol. 28 (4): 261-263. 31 Dec. 1974. SFA 22(2)

[Dep. Anat., Coll. Med. Dent., Newark, NJ] A single application of 100 parts per billion Seven in seawater caused disruption of schooling behavior of /Menidia menidia/ in an artificial setting. Although the change, primarily a spreading out of the school over a larger area, was observed after 24 h exposure, placing the fish in clean water did not bring about a return of normal schooling patterns until 72 h. This is attributed to the accumulation of 1-naphthol, a toxic product of hydrolysis of Sevin. The adaptive significance of changes in schooling behavior is discussed.

76-000737 Wildish, D. J.; Lister, N. A. EFFECTS OF DIETARY FENITROTHION ON GROWTH AND HIERARCHICAL POSITION IN BROOK TROUT. Prog. Fish-Cult. 39 (1): 3-9. Jan. 1977. SFA 22(2)

[Dep. Environ., Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] At a dietary level of 10 mg/kg of wet food (=11.5 mg/kg dry food) the organophosphorothionate insecticide, fenitrothion, does not affect growth or dominance patterns of brook trout (/Salvelinus fontinalis/) at dry ration levels up to 4.45 percent of body dry weight per day. The method devised for this study allows the individual ration per fish per day to be determined for small groups of up to 20 fish per tank. The method is useful in fish toxicology, where effects of exposure to dietary contaminants must be determined; for testing individual growth and food conversion efficiency; and in determining behavioral dominance patterns.

76-000738 Zitko, V.; Carson, W. G. SEASONAL AND DEVELOPMENTAL VARIATION IN THE LETHALITY OF ZINC TO JUVENILE ATLANTIC SALMON (/SALMO SALAR/). J. Fish. Res. Board Can. 34 (1): 139-141. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Environ., Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] The incipient lethal level (ILL) of zinc to juvenile Atlantic salmon (/Salmo salar/) in fresh water at a water hardness of 14 mg/l varies from 150 to 1000 ug/l as a function of season and developmental state of the fish. The ILL increases from 500 to 1000 ug/l during the 1st year and decreases to 150 ug/l in the following spring. The more sensitive stage in the salmon's life history, evidenced by decrease of ILL coincides with and is probably related to initial stages of the parr-smolt transformation.

FISH TOXICANTS

76-000739 Marking, L. L.; Bills, T. D. TOXICITY OF ROTENONE TO FISH IN STANDARDIZED LABORATORY TESTS. U.S. Fish Wildl. Serv. Invest. Fish Control 72. 11p. 1976. SFA 22(2)

[U.S. FWS, Fish Control Lab., P.O. box 862, La Crosse, WI 54601] Noxfish, which contains 5 percent rotenone, was toxic to a variety of freshwater fish at concentrations ranging from 21.5 to 497 ug/l in 96-h laboratory exposures. Goldfish (/Carassius auratus/) and black bullheads (/Ictalurus melas/) were the most resistant species, and the Atlantic salmon (/Salmo salar/) was the most sensitive. Toxicity was influenced little by temperatures of 7 to 22 C, by water hardnesses of 10 to 300 mg/l, or by pH's of 6.5 to 9.5. In exposures of rainbow trout (/Salmo gairdneri/), newly fertilized eggs were much more resistant than fingerlings. Noxfish detoxified in water solutions; the half-life of biological activity was 22 days at 12 C and 13 days at 17

76-000739 CONTINUED
C. Potassium permanganate was an excellent detoxifier; chlorine was less efficient. Noxfish was consistently more toxic in static tests than in flow-through tests.

RESEARCH AND MANAGEMENT-GENERAL

76-000740 Horn, M. H. IN HONOR OF CARL L. HUBBS. Bull. South. Calif. Acad. Sci. 75 (2): 57-59. Aug. 1976. SFA 22(2)
[Dep. Biol., Calif. State Univ., Fullerton 92634]

76-000741 Stone, M. CONCEPTS OF FISHERIES MANAGEMENT. Wyo. Wildl. 41 (2): 32-34. fFeb. 1977. SFA 22(2)
[Wyo. Game Fish Comm., Cheyenne 82002]

ADMINISTRATION AND PLANNING

76-000742 Bray, H. (chairman); Brown, D. L. (discuss. leader) NEW REQUIREMENTS AND APPROACHES FOR FISH AND WILDLIFE PLANNING. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 97-156. 1975. SFA 22(2)
Eight papers dealing with fish and wildlife planning on the state and national levels.--RS

REPORTS OF FISHERY STATIONS, STATES, ETC.

76-000743 Sarig, S. FISHERIES AND FISH CULTURE IN ISRAEL IN 1975. Bamidgeh 28 (4): 67-79. Dec. 1976. SFA 22(2)
[Lab. Res. Fish Dis., Nir-David, Israel]

76-000744 Singapore Marine Fisheries Research Department MARINE FISHERIES RESEARCH DEPARTMENT ANNUAL REPORT, 1975. Southeast Asian Fish. Develop. Cent., Singapore iii + 48p. July 1976. SFA 22(2)
[Southeast Asian Fish. Develop. Cent., Singapore]

HABITAT ALTERATION

76-000745 Blahm, T. H. EFFECTS OF WATER DIVERSIONS ON FISHERY RESOURCES OF THE WEST COAST, PARTICULARLY THE PACIFIC NORTHWEST. Mar. Fish. Rev. 38 (11): 46-51. Nov. 1976. SFA 22(2)
[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000746 Collins, G. B. EFFECTS OF DAMS ON PACIFIC SALMON AND STEELHEAD TROUT. Mar. Fish. Rev. 38 (11): 39-46. Nov. 1976. SFA 22(2)
[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000747 Feller, M. C. INITIAL EFFECTS OF CLEARCUTTING ON THE FLOW OF CHEMICALS THROUGH A FOREST-WATERSHED ECOSYSTEM IN SOUTHWESTERN BRITISH COLUMBIA. Ph. D. dissertation, Univ. British Columbia 1975. [Order microfiche copy from the National Library of Canada at Ottawa.] From Diss. Abstr. Int. B Sci. Eng. 36(7), 1976. SFA 22(2)
[Five small watersheds were studied in the University of B.C. Research Forest, for periods of up to three years prior to clearcutting and up to two years following clearcutting. The streams were characterized by high discharges from late autumn until early summer and low discharges from May until October, with almost no contribution from snowmelt run-off. Responses to precipitation was fairly rapid and it was hypothesized that stormflow arose mainly from flow of water through macrochannels in the soil. There was an increase of 30.8 cm in run-off from one watershed, and 27.6 cm from another during the first six months of the dormant season immediately following clearcutting. Clearcutting caused an increase in both maximum and minimum stream temperatures during the first dormant season following clearcutting. Clearcutting had little effect on dissolved oxygen values during the cooler wetter months but caused very pronounced decreases during summer and early autumn. Clearcutting increased the pH of water reaching the forest floor and surface runoff but decreased the pH of mineral soil leachate, groundwater, and streamwater. It generally decreased chemical concentrations in water reaching the forest floor and in surface runoff, and, to a lesser extent, in forest floor and mineral soil leachates, but it increased concentrations in groundwater, and, to a lesser extent, in stream water. A most notable increase throughout the system was in the concentration of potassium. All changes were most noticeable during the low flow periods. From the nutrient viewpoint, it appears that clearcutting has not impaired the mechanisms for nutrient retention in the ecosystems of the type present in the study area. This may not be the case for all ecosystems in coastal B.C., or for other forestry practices, such as slashburning.--From abstr.

76-000748 Hokenstrom, J. C. SOIL WATER CONCENTRATIONS OF SELECTED IONS FOLLOWING CLEARCUTTING OF A LODGEPOLE PINE FOREST. Ph. D. dissertation, Colo. State Univ. 132p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)
The data suggest that, following clearcutting of lodgepole pine forests, significant increases in soil water concentrations of nitrate and calcium can be expected for up to 9 years after cutting. Implications of nutrient additions to streams draining clearcut areas are discussed.--From abstr.

76-000749 Kaplan, E. H.; Welker, J. R.; Kraus, M. G.; McCourt, S. SOME FACTORS AFFECTING THE COLONIZATION OF A DREDGED CHANNEL. Mar. Biol. 32 (2): 193-204. 30 Sept. 1975. SFA 22(2)
[Biol. Dep., Hofstra Univ., Hempstead, NY] Standing crop, population size, and species diversity of the macrobenthic organisms in an estuarine channel were studied before and after dredging. A new suction-corer which sampled an area 0.1 m^2 to a depth of 30 cm was used in order to insure the inclusion of large, deep-dwelling animals. Eleven months after dredging, biomass and number of species and specimens had not recovered to pre-dredging levels. Colonization began

76-000749 CONTINUED
with relatively large, swiftly moving forms. Stations in silt and mud regions recovered more slowly than those in sandier sediments. Most of the dominant and subdominant species had not recovered 11 months after dredging, and the previously abundant polychaetes /Notomastus latericeus/ and /Clymenella torquata/ had virtually disappeared. Only relatively uncommon lamellibranchs increased after dredging. Distribution of sediment types changed as the result of modified tidal velocities in the channel. Mud and silt were removed by the dredge, exposing the sand underneath, and sandy stations became muddier as the result of lowered current velocities. Marked changes in species commposition reflected this change in sediment character. Eleven months after dredging no evidence of succession was found, but colonization had begun. Values of all three parameters studied were reduced to small fractions of pre-dredging levels, although species diversity in sandy sediments exceeded pre-dredging levels.--From abstr.

76-000750 Snyder, G. R. EFFECTS OF DREDGING ON AQUATIC ORGANISMS--WITH SPECIAL APPLICATION TO AREAS ADJACENT TO THE NORTHEASTERN PACIFIC OCEAN. Mar. Fish. Rev. 38 (11): 34-38. Nov. 1976. SFA 22(2)
[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000751 Wiley, R.; Dufek, D. STREAM ALTERATION AND TROUT PRODUCTION. Wyo. Wildl. 41 (2): 30-31. Feb. 1977. SFA 22(2)
[Wyo. Game Fish Comm., Green River]

76-000752 Zimmer, D. W. THE EFFECTS OF LONG-REACH CHANNELIZATION ON HABITAT AND INVERTEBRATE DRIFT IN SOME IOWA STREAMS. Ph. D. dissertation, Iowa State Univ. 90p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)
Relationships between channel morphometry, habitat diversity, and invertebrate drift density were studied in 11 natural and channelized stream segments of the upper Des Moines River Basin during 1974 and 1975. Gradients of the study sites ranged from 0.17 to 2.18 m/km; sinuosity index values were between 0.95 and 1.67. The most obvious effect of channelization on stream habitat was a reduction in the diversity of water depth and diversity of current velocity. There was a significant (P=.05) positive correlation between channel sinuosity and the variability of stream depth and velocity. Invertebrate drift density, expressed as biomass and total counts, was also correlated with channel sinuosity. Sinuous streams had greater concentrations of drifting organisms than did straight channels. There was no relationship between drift density and channel gradient.

HARVEST, CREEL CENSUS

76-000753 Seitz, W. K.; Dahlgren, R. B. WATER-BASED RECREATIONAL USE PATTERNS OF THE UPPER IOWA RIVER. Iowa State J. Res. 50 (2): 131-145. Nov. 1975. SFA 22(2)
[U.S. FWS, Div. River Basin Stud., Tulsa, OK 74103] A recreational use study was conducted on a 74-mile stretch of the Upper Iowa River in northeastern Iowa in 1972 and 1973. More than 73 percent of all recreational parties contacted were canoeing. In 1973, 6,529 canoeist-days were recorded during a 101-day period beginning May 26, a 38 percent increase over 1972. One 30-mile section of the river (Kendallville-Decorah) received 83 percent of all canoeing use. Over

76-000753 CONTINUED
60 percent of the canoeing and camping activity was on weekends, with peak use during national holidays. In 1973, 4,791 camping nights were recorded in a 102-day period beginning May 25, an 18 percent increase over 1972. Over 42 percent of the recorded camping nights were on private land, primarily at Bluffton. Fishing was third in use, with almost 48 percent of the recorded fishing activity occurring in a 20-mile stretch of the river from the Lower Dam, the most heavily fished spot in the river study area, downstream to State Highway 76. Trapping was also surveyed; over 58 percent of 11,010 trap-nights occurred in the 22-mile section of river from Bluffton to the Lower Dam.

REGULATIONS

76-000754 Kruger, R. F. ANOTHER MISSOURI FIRST... Mo. Conserv. 38 (2): 15-17. Feb. 1977. SFA 22(2)
[Jennings, MO] Discusses a new catch-and-release trout program at Bennett Spring, Missouri.--RS.

FISH CONTROL AND REMOVAL

76-000755 Bartoo, N. W. PROPORTIONS OF A YELLOW PERCH POPULATION SURFACING AFTER A ROTENONE TREATMENT. Prog. Fish-Cult. 39 (1): 27-28. Jan. 1977. SFA 22(2)
[Wash. Coop. Fish. Res. Unit, Coll. Fish., Univ. Wash., Seattle 98195]

76-000756 Baumann, P. C. AN EVALUATION OF THE USE OF ANTIMYCIN A FOR STREAM RECLAMATION IN THE ROCK RIVER, WISCONSIN. Ph. D. dissertation, Univ. Wis. (Madison) 119p. 1975. From Diss. Abstr. Int. B Sci. Eng. 37(1), 1976. SFA 22(2)
The Wisconsin Department of Natural Resources used Antimycin A (at minimum concentrations of 15 ug/l) to poison two sections of the Rock River (Wisconsin) totaling 805-km of stream and 12,140-ha of impounded waters in the fall of 1971 and 1973. Treated waters were restocked with sport species the following springs. Seine and shocker surveys documented reinvasion by forage species. Creel census data indicates most fishermen utilizing the Rock River are local. The major fishery in terms of anglers, angler-hours, and total catch was for bullhead (largely /Ictalurus melas/). Treatment of both sections initially increased the panfish catch. Gamefishing improved in the section treated in 1971, although no improvement was seen during the first years after treatment in the section treated in 1973. Gamefish and panfish catch and catch per unit effort fell dramatically between the second and third years after treatment on the upper section, leaving in doubt how large a natural population of predatory gamefish could be established. Most fish species present in the East Branch Rock River four years after treatment were either resistant Antimycin A or were reintroduced with stocking. Four species were either introduced as bait fish or reinvaded the section. Nine species (mainly minnows and darters) have not been taken since the treatment. Four of these were common prior to treatment. No over-all recreational improvement has been produced by the Rock River reclamation to date. Sport fishery return has not noticeably increased. Continual restocking may be necessary due to winterkill conditions caused by increased macrophyte abundance. Toxicant treatment and restocking alone appear to be ineffective in managing a large eutrophic river system.--From abstr.

MARKING AND TAGGING

76-000757 Carr, W. E. S. HARNESS FOR ATTACHMENT OF AN ULTRASONIC TRANSMITTER TO THE RED DRUM, /SCIAENOPS OCELLATA/. NOAA Fish. Bull. 74 (4): 998-1000. Oct. 1976. SFA 22(2)
[Whitney Mar. Lab., Univ. Fla. Marineland, Rt. 1, Box 121, St. Augustine 32084]

STOCKING AND INTRODUCTIONS

76-000758 Eccles, D. H. FISHES OF THE AFRICAN GREAT LAKES AS CANDIDATES FOR INTRODUCTION INTO LARGE TROPICAL IMPOUNDMENTS. J. Fish Biol. 7 (3): 401-405. May 1975. SFA 22(2)
[Fish. Res. Unit, P.O. Box 27, Monkey Bay, Malawi, Africa] The lakes formed by large power dams are populated by basically riverine faunas. The African Great Lakes are populated by highly specialized endemic faunas containing the bulk of the world's lacustrine fish species. Examples from the fauna of Lake Malawi are considered to illustrate the utilization of various niches, and it is suggested that such specialized species should be introduced into large tropical impoundments to utilize niches probably not fully occupied at present. Such introductions would pose little threat to the ecosystem of the rest of the river system into which they are introduced because of their close specialization to lacustrine conditions.

76-000759 Kennedy, J. J.; Wood, D. B. FISHERMAN REACTION TO THE STOCKING OF ALBINO TROUT IN UTAH. prog. Fish-Cult. 39 (1): 16-17. Jan. 1977. SFA 22(2)
[Dep. Forestry Outdoor Recreation, Utah State Univ., Logan 84322]

76-000760 Klein, W. D. FISHING USE, HARVEST, AND STOCKING EVALUATIONS AT WEST AND DOWDY LAKES. Colo. Div. Wildl. Div. Rep. No. 7. piii + 57p. July 1976. SFA 22(2)
[Colo. Div. Wildl., Fort Collins 80521] The present investigation was initiated in 1972 and continued to 1975 to further measure the West and Dowdy Lake fishery and in particular to evaluate and compare fingerling plants of brown and rainbow trout in West Lake. Limited observations also were made on fingerling Snake River cutthroat trout (/Salmo clarki/) released in West and Dowdy Lakes and on a plant of smallmouth bass (/Micropterus dolomieui/) in Dowdy Lake.--From intro.

76-000761 Plosila, D. S. RELATIONSHIP OF STRAIN AND SIZE AT STOCKING TO SURVIVAL OF LAKE TROUT IN ADIRONDACK LAKES. N.Y. Fish Game J. 24 (1): 1-24. Jan. 1977. SFA 22(2)
[N.Y. State Dep. Environ. Conserv., Albany 12201] Experimental stockings of over 206,000 Seneca Lake strain and over 209,000 Upper Saranac Lake strain lake trout were made in nine lakes in northeastern New York from 1964 to 1968. They comprised fall fingerlings, spring yearlings and fall yearlings and were fin clipped to identify the strain and age at stocking. Recoveries of marked fish obtained by gill netting, trap netting, angling and pond reclamation were used to measure survival. A total of 1,812 lake trout from these lakes were examined from 1965 to 1973 among which were 495 that had been stocked

76-000761 CONTINUED
for this study. The Upper Saranac Lake strain comprised 94.3 per cent (467), while the Seneca Lake strain constituted 5.7 per cent (28) of the recoveries. Relative survival for all lakes combined was 15.9 : 1 in favor of the Upper Saranac Lake strain. The ratio of survival according to age at stocking (fall fingerlings : spring yearlings : fall yearlings) for all lakes combined was 1 : 9.5 : 8.7. Considering the similar recovery rates for the two yearling groups, lower rearing costs for spring yearlings favor this age group for stocking purposes. Strain was more important than the size of the fish or the season of the year when stocking was done in determining survival. It was concluded that the Seneca Lake strain is not suitable for stocking Adirondack lakes. For lake trout stocking programs in these waters, spring yearlings of the Upper Saranac Lake strain or other Adirondack stock should be used.

FISHING GEAR AND TECHNIQUES

76-000762 Brown, D. J. A.; Langford, T. E. AN ASSESSMENT OF A TOW NET USED TO SAMPLE COARSE FISH FRY IN RIVERS. J. Fish Biol. 7 (4): 533-538. July 1975. SFA 22(2)
[Cent. Elec. Res. Lab., Freshwater Biol. Unit, Ratcliffe-on-Soar Power Stn., Nottingham NG11 0EE, England] The design and use of a tow net for sampling coarse fish fry in rivers are described, and its performance over a year is discussed with regard to species selectivity and size selectivity. The extent to which it can be used to provide data on the comparative abundances of the fry and their mean lengths and associated variances are described.

76-000763 Burress, R. M.; Gilderhus, P. A.; Cumming, K. B. FIELD TESTS OF ISOBORNYL THIOCYANOACETATE (THANITE) FOR LIVE COLLECTIONS OF FISHES. U.S. Fish Wildl. Serv. Invest. Fish Control 71. 13p. 1976. SFA 22(2)
[U.S. FWS, Southeast. Fish Control Lab., P.O. Box 9, Warm Springs, GA 31830] Eight ponds containing a total of 28 species of fish were treated with isobornyl thiocyanoacetate (Thanite) to test its efficacy for the live collection of fish. Twenty-six species were collected alive after 1- to 4-ul/l applications of Thanite. Most scalefishes except carp (/Cyprinus carpio/) were relatively easy to collect, and catfishes (Ictaluridae) were generally the most resistant to effects of the chemical. With the exception of northern pike (/Esox lucius/), most fish recovered quickly after being placed in fresh water. Most fish collected within 1.5 h after treatment survived, but survival rates decreased with time of exposure. The concentrations effective for collection of live fish did not routinely eliminate all fish; small numbers of at least eight species of fish survived treatments of 1.5 ul/l or more. The high percentages of fish (of most species) collected alive demonstrated that Thanite is effective for the intended purpose.

76-000764 Cross, D. G.; Stott, B. THE EFFECT OF ELECTRIC FISHING ON THE SUBSEQUENT CAPTURE OF FISH. J. Fish Biol. 7 (3): 349-357. May 1975. SFA 22(2)
[Stat. Off. European Communities, Cent. European, Kuchberg, Luxembourg] Experiments show that the first of a series of replicate electric fishings can cause a decrease in catchability so that the second and subsequent catches are made from what is, effectively, a reduced population. Depletion (DeLury) estimates can be thus seriously low. Species affected are roach /Rutilus rutilus/ (L.) gudgeon /Gobio

76-000764 CONTINUED
gobio/ (L.), rudd /Scardinius erythophthalmus/ (L.) and, from other published data, probably rainbow trout /Salmo gairdneri/ Richardson and eels /Anguilla anguilla/ (L.). being caught does not, apparently, cause fish to become less catchable. The reason why electric field causes a proportion of a population to become uncatchable is obscure but it may be that refractory behaviour is involved; the effect lasts for between 3 and 24 h. A method is given for adjusting DeLury estimates for decreased catchability.

76-000765 Cross, D. G. A METHOD OF COMPARING THE EFFICIENCIES OF ELECTRIC FISHING OPERATIONS. J. Fish Biol. 9 (3): 261-265. Sept. 1976. SFA 22(2)
[Agric. Forestry Fish. Div., State Office European Communities, P.O. Box 1907, Luxembourg] A method is described whereby the efficiencies of two electric fishing machines may be compared by fishing a closed population on eight occasions at short intervals, the two fishing machines being used alternately. A practical example is given and the merits of the method are discussed.

76-000766 Keene, D. F.; Pearcy, W. G. COMPARISON OF THE MOST SUCCESSFUL AND LEAST SUCCESSFUL WEST COAST ALBACORE TROLL FISHERMEN. NOAA Fish. Bull. 74 (4): 973-982. Oct. 1976. SFA 22(2)
[BLM, 300 N. Los Angeles St., Los Angeles, CA 90012] Catch data for albacore troll boats were collected from fishermen's logbooks and from dockside interviews during 1968, 1969, and 1970 seasons. Fishing powers of these boats were calculated and used to determine the 10 most successful and 10 least successful fishermen (highliners and lowliners, respectively) who fished off Oregon and Washington. Characteristics of these two groups of fishermen were then compared. In general, highliners had longer boats and fished nearer the fleet center and along the offshore margin of the fleet. Lowliners tended to have smaller boats and fished along the trailing (south) inshore margin of the fleet. Both groups responded to changes in apparent albacore abundance by aggregating on days of high apparent abundance, although this response was less pronounced in 1969 and 1970. Highliners caught significantly smaller (but more) fish than the lowliners.

76-000767 Rutter, R. P.; Ettinger, W. S. METHOD FOR SAMPLING INVERTEBRATE DRIFT FROM A SMALL BOAT. Prog. Fish-Cult. 39 (1)d 49-52. Jan. 1977. SFA 22(2)
[Ichthyological Assoc., Inc., Fricks Lock Road, Pottstown, PA 19464] We describe a method for sampling invertebrate drift from a small boat, using a beam to which conventional drift samplers are attached; the beam is mounted on the oarlocks. This method permits sampling-unit replication and enables the collection of drift from the upper strata of water in large rivers in areas that might be inaccessible to conventional methods.

76-000768 Weiss, D. M. A HIGH POWER PULSE GENERATOR FOR ELECTRIC FISHING--REVISED CIRCUIT. J. Fish Biol. 9 (2): 119-123. Aug. 1976. SFA 22(2)
[Salmon Freshwater Fish. Lab., Minist. Agric. Fish. Food, 10 Whitehall Place, London SW1 2HH, England] A circuit for a pulsed d.c. fishing machine is described which represents substantial advantages over a previously published design. The present circuit has been fully field tested and is giving satisfactory service in routine fish population sampling in high conductivity water (up to at least 2000 uS/cm).

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

76-000769 McCosker, J. E.; Dawson, C. E. BIOTIC PASSAGE THROUGH THE PANAMA CANAL, WITH PARTICULAR REFERENCE TO FISHES. Mar. Biol. 30 (4): 343-351. 20 June 1975. SFA 22(2)

[Steinhart Aquarium, Calif. Acad. Sci., San Francisco] The effectiveness of the Gatun Lake fresh-water barrier to fish migration of the Panama Canal was examined, based on literature records and recent collections. Six species have migrated to the Pacific and three to the Atlantic Oceans. New records include: /Hypleurochilus aequipinnis/, /Barbulifer ceuthoecus/ and /Oostethus lineatus/ of Atlantic origin, and /Gnathanodon speciosus/ of Pacific origin. The majority of Atlantic migrants are known in the Pacific only from the Maraflores Third Lock, a unique ectogenic meromictic lake attached to the Pacific entrance of the canal. The hydrography and biota (including Atlantic algal and crustacean species previously unknown as canal migrants) of the lake are discussed. It is presumed that certain fish migrants transited the canal by associating with fouling material on the underside of ships. The euryhaline species /H. aequipinnis/, /Lupinoblennius dispar/, /Lophogobius cyprinoides/ and /Omobranchus punctatus/ survived in freshwater (0.0°/ooS) for periods longer than required for ship transit of the canal (ca. 8 h). The stenohaline migrant /Gobiosoma nudum/ died after 2 h in freshwater, but survived more than 5 h at 2.5°/ooS. Plans to increase Panama Canal ship transits through the pumping of seawater into Gatun Lake might remove the biological barrier and allow the migration of euryhaline and stenohaline species. We find those plans unwise, and the potential consequences dangerous.

MATHEMATICS, STATISTICAL METHODS AND MODELING

76-000770 Gerritsen, J.; Strickler, J. R. ENCOUNTER PROBABILITIES AND COMMUNITY STRUCTURE IN ZOOPLANKTON: A MATHEMATICAL MODEL. J. Fish. Res. Board Can. 34 (1): 64-72. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Earth Planet. Sci., Johns Hopkins Univ., Baltimore, MD 21218] Predator-prey interactions between swimming animals of the zooplankton are studied in a mathematical model. The assumptions are: 1) the animals are points in a 1-m^3 homogeneous space, 2) the animals move at random and are randomly distributed, and 3) the predator animal has an encounter radius given by its sensory system. The mathematics of encounter probabilities are developed for a 3-dimensional space. The results show two optimal strategies: 1) cruising predators which prey upon slow moving animals (herbivores), and 2) ambush (nonmoving) predators which prey upon fast cruising prey. Of the variables used (population densities, speeds of the two animal species, and encounter radius) the encounter radius has the greatest influence on the encounter probabilities. The results suggest a simple community structure and point to the importance of studies on live zooplankton.

76-000771 Hilborn, R.; Walters, C. J. DIFFERING GOALS OF SALMON MANAGEMENT ON THE SKEENA RIVER. J. Fish. Res. Board Can. 34 (1): 73-82. Jan. 1977. In English with French summ. SFA 22(2)

[Dep. Environ., Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada] In this paper we describe the use of a specific decision analysis tool, multiattribute utility analysis, to investigate conflicting goals in the management of salmon on the Skeena River. We used this technique to determine the preferences of 10 individuals representing several interest groups and different management agencies. It is shown how individuals differ in their preferences, how conflicts can be identified, and how decision analysis can be used to refine an individual's understanding of his preferences. Individuals assessed possible outcomes of different alternative enhancement proposals using two techniques, the decision analysis technique and an intuitive approach. These two methods produced different results. The use of these techniques in the management process is discussed.

76-000772 Keeney, R. L. A UTILITY FUNCTION FOR EXAMINING POLICY AFFECTING SALMON ON THE SKEENA RIVER. J. Fish. Res. Board Can. 34 (1): 49-63. Jan. 1977. In English with French summ. SFA 22(2)

[Woodward-Clyde Consultants, Two Embarcadero Cent., San Francisco, CA 94111] The interests of many groups, some with multiple objectives, are important to include in evaluating strategies affecting salmon in the Skeena River. A multiattribute utility model is proposed for addressing these issues. Two first-cut utility functions are assessed using the preferences of two individuals familiar with the problem. These utility functions provide a basis for constructive discussion to arrive at a reasonable utility function for examining alternative policies. Two unique features of this study are the explicit focus on value tradeoffs and equity considerations among interest groups, and a comparative examination of the two first-cut multiattribute utility models. This examination indicates the range of fundamental preferences which can be captured using multiattribute utility functions and illustrates the potential of the theory for conflict illumination and resolution.

76-000773 Lord, G. E. DECISION THEORY APPLIED TO THE SIMULATED DATA ACQUISITION AND MANAGEMENT OF A SALMON FISHERY. NOAA Fish. Bull. 74 (4): 837-846. Oct. 1976. SFA 22(2)

[Appl. Physics Lab., Univ. Wash., Seattle 98195] A salmon fishery management model utilizing statistical decision theory has been constructed. The model provides for the successive acquisition of data that can be used to formulate and maintain an optimum management strategy. The Bayes risk is defined as the expected economic loss resulting from a set of fishery management decisions and the criterion of optimality is taken to be the strategy that minimizes the Bayes risk. Specific functional forms are assumed where necessary in order to obtain a closed form expression for the Bayes risk. The Bayes risk, in units of numbers of fish, can then be computed for any particular sequence of fishery management decisions.

76-000774 Scherba, S., Jr.; Gallucci, V. F. THE APPLICATION OF SYSTEMATIC SAMPLING TO A STUDY OF INFAUNA VARIATION IN A SOFT SUBSTRATE ENVIRONMENT. NOAA Fish. Bull. 74 (4): 937-948. Oct. 1976. SFA 22(2)

[Dep. Physiol. Biophys., Univ. Wash., Seattle 98195] Stratified systematic sampling was applied to an intertidal macrofauna sediment study. A stratified systematic sampling plan retains the advantages of the more common fixed level transect sample, and possesses additional advantages which recommend it for use in some intertidal studies. The field data collected in this study demonstrated the effectiveness of stratified systematic sampling for quantifying both sediment and population characteristics along a sediment gradient, and for the testing of biological hypotheses. Intraarea, interarea, and interseason hypotheses about sediment composition were tested in terms of particle size distributions. Populations of bivalves and polychaetes were simultaneously sampled and hypotheses concerning spatial and seasonal variations in an intertidal mud flat were tested. Experimental results using stratified systematic sampling suggest that Newell's hypothesis can be extended to encompass temporal variation. Fine sediment grades (silty areas) may act to insulate infauna against the extremes of seasonal stresses. Sediment composition, as measured by the average percentage composition by weight of various grain sizes, was not sufficient to predict macrofaunal presence.

ACCESS

76-000775 Reese, A.; Kuntz, B. FISHING EASEMENTS PROGRAM. MUTUAL BENEFITS FOR LANDOWNERS AND FISHERMEN. Wyo. Wildl. 41 (2): 4-6. Feb. 1977. SFA 22(2)

[Wyo. Game Fish Comm., Cheyenne 82002] Discusses the Wyoming Game and Fish Commission's stream easement program to provide fishing access.--RS

LAKE MANAGEMENT & RESEARCH

76-000776 Emery, A. R. STUNTED BASS: A RESULT OF COMPETING CISCO AND LIMITED CRAYFISH STOCKS. IN H. Cleppler, ed. Black Bass Biology and Management. Sport Fishing Inst., Washington, D.C. 154-164. 1975. SFA 22(2)

[Royal Ontario Museum, Toronto, ON, Canada]

76-000777 Goldspink, C. R.; Banks, J. W. A DESCRIPTION OF THE TJEUKEMEER FISHERY TOGETHER WITH A NOTE UPON THE YIELD STATISTICS BETWEEN 1964 AND 1970. J. Fish Biol. 7 (5): 687-708. Sept. 1975. SFA 22(2)

[Didsbury Coll. Educ., Wilmslow Rd., Manchester, England] The catch of seven species of fish at the Tjeukemeer fishery between 1964 and 1969 is given. This period includes an important change in the fishing method. The catches are dominated by three species, the pike-perch, bream and the eel. The yield of the pike-perch is large and probably a reflection of the high production of the lake. The seasonal pattern of the catches is discussed with particular reference to fishing mortality. A general decline in the yield of bream is noted. However, the yield of eels has been consistently high throughout the period. These data provide a valuable insight into the composition of the fish community within the lake.

RIVER AND STREAM MANAGEMENT & RESEARCH

76-000778 Mason, J. C. RESPONSE OF UNDERYEARLING COHO SALMON TO SUPPLEMENTAL FEEDING IN A NATURAL STREAM. J. Wildl. Manage. 40 (4): 775-788. Oct. 1976. SFA 22(2)

[Environ. Canada, Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Food rather than space was found to limit the stream production of juvenile coho salmon during the summer. The carrying capacity of a small Vancouver Island stream was increased 6-7 fold above natural levels by augmenting the natural food supply with a daily feeding of thawed marine euphausiids. Growth and biomass yield of unfed populations were inversely related to population density. Supplemental feeding cancelled the density effect on survival and outmigration, accelerated growth rate, and substantially increased the pre-winter lipid reserve, thus potentially increasing resistance to starvation during winter. During the summer season of low streamflow, juvenile coho populations may be regulated at biomass levels commensurate with smolt yield in the subsequent spring. The 6-fold increase in potential smolt yield induced by supplemental feeding during summer was nullified by the natural carrying capacity of the stream over winter. Projected smolt yield from the remnant population in late winter following several freshets approximated that expected from natural levels of production. The probability of increasing smolt yield by relieving the natural food limits on density and production during the summer season remains most uncertain unless (1) the carrying capacity over winter of the specific stream is known already to exceed natural levels of summer population to an appropriate degree, or can be increased to that degree by manipulating environmental factors, and (2) food supply is again augmented in the subsequent spring until the smolts migrate to sea. Attempts to increase carrying capacity over winter by installing artificial refuges were unsuccessful.--From abstr.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT

76-000779 Johnson, D. L. A COMPARISON OF FLORIDA AND NORTHERN LARGEMOUTH BASS IN MISSOURI. Ph. D. dissertation, Univ. Mo. 122p. 1976. From Diss. Abstr. Int. B Sci. Eng. 37(4), 1976 SFA 22(2)

Florida largemouth bass were compared to the northern subspecies in both cages and ponds. In 1972, northern bass had significantly higher mean total length and weight increments than Florida bass. In 1973, there was no difference in length increments of northern and Florida bass although the northern bass had a significantly higher mean total weight gain and mean total consumption than the Florida subspecies. There was a similar relationship between Florida and northern bass in the pond and cage experiments but with a three-fold increment in open water as opposed to cages in 1973 for northern bass and a greater than four-fold increase for the Florida bass. This means that confinement greatly reduced growth and that the reduction of growth in cages may be greater in Florida than northern bass. No significant differences in length-weight regression lines were found for the two subspecies in the same environments. In small ponds, mean annual survival of northern bass fingerlings was 65 percent (92-57 percent); Florida bass survival was 4 percent (8-0 percent). In laboratory tests of temperature tolerance at 4 C (39 F), survival of Florida bass was 0 percent and northern bass about 86 percent. In further laboratory

76-000779 CONTINUED
tests, gradual cooling of 1 C (1.8 F) per day from 15 C (59 F) to 4 C (39 F) resulted in 0 percent survival of Florida bass and 85 percent survival of northern bass. Florida bass tended to react to handling with more vigorous activity than northern bass; Florida bass exhibited a higher incidence of handling-related diseases. The results of these studies indicate that the Florida largemouth bass offers no advantage and little promise for management in most Missouri ponds and reservoirs.--From abstr.

LARGE IMPOUNDMENT MANAGEMENT & RESEARCH

76-000780 Axon, J. R. EVALUATION OF THE "TWO-STORY" TROUT FISHERY IN LAKE CUMBERLAND. Ky. Dep. Fish Wildl. Resour., Fish. Bull. No. 60. 69p. 1974. SFA 22(2)
[Ky. Dep. Fish. Wildl. Resour., Frankfort] The two major problems encountered in developing the trout fishery in Lake Cumberland are the loss of trout by predation, and escapement through the discharge at the dam. By stocking trout that average 230 mm (9 in) in length, most of the predation by black basses can be avoided. Results of the predation studies indicated that black basses utilized trout that were less than 203 mm (8 in) in length. Whether the stocking of 230 mm trout will also reduce predation by striped bass, /Morone saxatilis/ (Walbaum), is questionable. To minimize the escapement of trout through the dam, trout should be stocked a safe distance from the dam. Trout stocked in February contributed more to the catch than did the October stocking every year between 1969 and 1972. In 1971, returns from the February stocking outnumbered returns from the October 1970 stocking by a ratio of 74:1. A re-evaluation of the trout fishery in Lake Cumberland should be made after the fishery has been given at least three years to develop following the recommendations described.--From abstr.

76-000781 June, F. C. CHANGES IN YOUNG-OF-THE-YEAR FISH STOCKS DURING AND AFTER FILLING OF LAKE OAHE, AN UPPER MISSOURI RIVER STORAGE RESERVOIR, 1966-74. U.S. Fish Wildl. Serv. Tech. Pap. 87. 25p. 1976. SFA 22(2)
[U.S. FWS, P.O. Box 698, Pierre, SD 57501] The young-of-the-year fish stocks of Lake Oahe were sampled with a 30.5-m by 2.4-m haul seine at semimonthly intervals, from July to September, in 1966-74. The catch comprised 41 species, of which 6 accounted for about 93 percent of the total number. Species numbers declined after the reservoir filled. Abundance increased and was highest in the lower third of the reservoir while it was filling, whereas it decreased and was generally highest in the upper two-thirds of the reservoir after it was filled. Forage fishes, mostly those produced in littoral areas, determined the trends and levels of total fish abundance. Abundance of species produced in littoral areas was greater while the reservoir was filling--particularly in years when spring water levels covered vegetation, fluctuated little, and were maintained through May or longer--than after the reservoir was filled. The yellow perch was the most abundant species in every year; its abundance increased during filling, but declined thereafter. Growth rate of yellow perch increased after the reservoir had filled; it was inversely related to the abundance of young-of-the-year yellow perch and emerald shiners and to the mean summer water temperature. Emerald shiners ranked second in abundance; their abundance also increased during filling and decreased thereafter. The post-filling decline reflected an increased mortality of yearling and older fish and reduced recruitment of young of the year. Reduction and generalized degradation of the littoral

76-000781 CONTINUED
spawning and nursey habitats were probably responsible for the general decline in species numbers and abundance after filling of the reservoir. As of the end of 1974, prospects for most commercial species (which are mainly littoral spawners) were poor, whereas those for certain sport species were good.--From abstr.

MARINE MANAGEMENT & RESEARCH

76-000782 Cassidy, F. L., Jr. THE RECREATIONAL VIEWPOINT ON A FISHERIES REGIME UNDER EXTENDED JURISDICTION. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 72-76. 1975. SFA 22(2)
[Wash. State Game Comm., Vancouver]

76-000783 Dykstra, J. J. COASTAL FISHERIES RESOURCES UNDER EXTENDED JURISDICTION. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 55-58. 1975. SFA 22(2)
[Point Judith Fishermen's Coop. Assoc., Inc., Narragansett, RI]

76-000784 Flanagan, C. A.; Hendrickson, J. R. OBSERVATIONS ON THE COMMERCIAL FISHERY AND REPRODUCTIVE BIOLOGY OF THE TOTOABA, /CYNOSCION MACDONALDI/, IN THE NORTHERN GULF OF CALIFORNIA. NOAA Fish. Bull. 74 (3): 531-544. July 1976. SFA 22(2)
[Dep. Ecol. Evol. Biol., Univ. Ariz., Tuscon 85721] Information gathered from fishers and records of the failing totoaba, /Cynoscion macdonaldi/, commercial fishery demonstrate the ability of the three principal ports to fully exploit the dwindling population during its annual breeding migration to the mouth of the Colorado River. Gonadal maturation, daily catch, and capture incidence data document the timing and route of migration, provide evidence for a tendency toward unisexual schooling in its early phase, and point to the possibility that totoaba may form large aggregations before spawning is initiated. A trend toward reduction in the length of the migratory and spawning period, from 5 or 6 mo in 1965 to 1 mo in 1972 is documented with data from the port of Golfo de Santa Clara. In surveys of the hypothesized nursery area, 28 juvenile totoaba (6-12 cm standard length) were collected at 4 of 14 sampling sites. The four collection sites were commonly characterized only by depth (less than 1 m) and substrate type (soft clay-silt sediments). Three hypothesized causes of the decline of this commercial fishery are examined by statistical analyses of Colorado River flow and annual totoaba catch data: overfishing, loss of spawning grounds, and loss of nursery grounds. Overfishing was found to be the most likely cause of the decline. The journey of the migrant population along a known route and its concentration into a predictable small area, its hypothesized requirement for dense aggregations prior to spawning, and the added mortality of juveniles taken by shrimp trawls in the near-delta waters are important points of vulnerability that render this endemic species particularly susceptible to fishing pressure. The possibility of the extinction of /Cynoscion macdonaldi/, without continuation of the newly decreed prohibition of fishing, is reiterated.--From abstr.

76-000785 Joseph, J. PROBLEMS ASSOCIATED WITH THE EXPLOITATION AND MANAGEMENT OF TUNAS AND BILLFISHES. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 63-71. 1975. SFA 22(2)
[Inter-American Tropical Tuna Comm., La Jolla, CA]

76-000786 McCracken, F. D.; Macdonald, R. D. S. SCIENCE FOR CANADA'S ATLANTIC INSHORE SEAS FISHERIES. J. Fish. Res. Board Can. 33 (9): 2097-2139. Sept. 1976. In English with French summ. SFA 22(2)
[Dep. Environ., Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

76-000787 Naab, R. C.; Branson, J. H. ENFORCEMENT AND SURVEILLANCE NEEDS UNDER EXTENDED FISHERIES JURISDICTION. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 86-90. 1975. SFA 22(2)
[NMFS, Juneau, AK]

76-000788 Nielsen, L. A. THE EVOLUTION OF FISHERIES MANAGEMENT PHILOSOPHY. Mar. Fish. Rev. 38 (12): 15-23. Dec. 1976. SFA 22(2)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853] The attitudes governing the management of fishery resources have evolved in important ways during the past 125 years. In 1850, the concept of inexhaustibility stood firmly entrenched, buttressed by tradition, history, the rights of freedom, an untested logic, and Thomas Henry Huxley. The increased fishery exploitation wrought by population increases and technological advances so depleted the stocks of valuable fish that by 1900 the concept of inexhaustibility was forced into submission. The logic of exhaustibility arose in response, and the simultaneous search for biological information and simple management solutions produced a predominant interest in maximizing the physical yield from aquatic environments. The undercurrent of nonbiological forces grew steadily as biologically oriented management failed to produce satisfactory benefits from fisheries resources. The emergence of numerous other criteria relevant to management has fostered the realization that the goal of fisheries management is to optimize society's total benefit from the use of natural resources.

76-000789 Norton, V. J. SCIENTIFIC AND ECONOMIC DATA NEEDS FOR EXTENDED FISHERIES JURISDICTION. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 77-85. 1975. SFA 22(2)
[Univ. R.I., Kingston 02881]

76-000790 Pollock, H. W. LAW OF THE SEA. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 49-53. 1975. SFA 22(2)
[NOAA, Washington, DC 20240]

76-000791 Roberts, R. DEVELOPMENT OF FISHERIES REGIMES UNDER EXTENDED FISHERIES JURISDICTION: SALMON RESOURCES. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 59-62. 1975. SFA 22(2)
[Fish. Manage. Serv., Dep. Environ., Vancouver, BC, Canada]

76-000792 Sissenwine, M. P. SOME ASPECTS OF THE POPULATION DYNAMICS OF THE SOUTHERN NEW ENGLAND YELLOWTAIL FLOUNDER (/LIMANDA FERRUNGINEA/) FISHERY. Ph. D. dissertation, Univ. R.I. 227p. 1975. From Diss. Abstr. Int. B Sci. Eng. 36(9), 1976. SFA 22(2)

Methods were developed and used to estimate the annual equilibrium catch, average growth per fish, and recruitment to the Southern New England yellowtail flounder fishery for the period 1944-1965. From 43 percent to 75 percent of the annual equilibrium catch of the fishery resulted from recruitment during this period. Since the equilibrium catch of the fishery was highly dependent on recruitment, it was meaningless to correlate equilibrium catch with the concurrent stock size. Little variation in the annual recruitment of the fishery was explained by variation in spawning stock size. The correlation coefficients of regressions fitted between the natural log of the annual equilibrium catch and recruitment to the fishery with three and four year moving averages of atmospheric temperature at Block Island, Rhode Island, ranged from 0.862 to 0.927 (significant at 1 percent level). All regressions indicated inverse relationsships. Since the equilibrium catch of the fishery reflects both growth and recruitment and since equilibrium catch and recruitment were shown to be correlated with temperature, the relationship between growth and temperature was investigated. The Kendall rank correlation coefficients of the annual average air temperature at Block Island with the annual average growth per fish for 1944-65 and with k for 1962-70 were negative and significant at the 5 percent and 1 percent levels, respectively. A linear stock-recruitment model accounted for 85.5 percent of the variability in the yield of the fishery for 1943-1965 with only minor tuning of a single parameter. The density independent stock-recruitment model also explained most of the variability in yield (83.2 percent), but required more tuning. The model explained the major trends in the fishery between 1943 and 1972, the years for which data were available.--From abstr.

76-000793 Stansby, M. E. ENVIRONMENTAL CHANGE AND THE NORTHEAST PACIFIC OCEAN FISHERIES: INTRODUCTORY REMARKS. Mar. Fish. Rev. 38 (11): 1-2. Nov. 1976. SFA 22(2)

[NMFS, Northwest Fish. Cent., 2725 Montlake Blvd. East, Seattle, WA 98112]

76-000794 Talbot, L. M. MAXIMUM SUSTAINABLE YIELD: AN OBSOLETE MANAGEMENT CONCEPT. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 91-96. 1975. SFA 22(2)

[Council on Environmental Quality, Washington DC 20006]

UTILIZATION OF FISHERY PRODUCTS

76-000795 Follett, W. I. FISH REMAINS FROM AN ARCHAEOLOGICAL SITE AT RANCHO CARRILLO ON THE SILVER STRAND, SAN DIEGO COUNTY, CALIFORNIA. Bull. South. Calif. Acad. Sci. 75 (2): 131-137. Aug. 1976. SFA 22(2)

[Dep. Ichthyol., Calif. Acad. Sci., San Francisco 94118] A collection of 170 fish remains from an archaeological site on the Silver Strand, immediately west of San Diego Bay, California, respresents nine species, all of which are edible: /Mustelus californicus/, /Sardinops sagax/, /Atherinopsis californiensis/, /Paralabrax/ sp., /Roncador stearnsii/, /Genyonemus lineatus/, /Cynoscion parvipinnis/, /Sphyraena argentea/, and /Pneumatophorus japonicus/. Remains of /Cynoscion parvipinnis/, a subtropical fish unknown from California in recent years, indicate the occurrence of a

76-000795 CONTINUED
former warmwater fauna in this vicinity, probably during more than two centuries. Remains of large /Sphyraena argentea/ and /Pneumatophorus japonicus/, probably caught in the ocean, suggest aboriginal use of the tule balsa.

MISC. TECHNIQUES AND EQUIPMENT

76-000796 Christensen, G. M.; Fiandt, J. T.; Benoit, D. A. ESTIMATION OF LIVE FISH WEIGHT BY PHOTOGRAPHY. Prog. Fish-Cult. 39 (1): 41-42. Jan. 1977. SFA 22(2)
[U.S. EPA, Environ. Res. Lab., 6201 Congdon Blvd., Duluth, MN 55804]
Approximate weights of fish were calculated from length and width measurements of their photographic images. In the calculations we employed the formula $Wt = KLW^2$, where Wt = weight (g); K = proportionality factor, derived from a subsample of the population under study; L = length (cm); and W = width (cm). When tested against true weights, the derived weights had a mean error of ±8.6 percent.

76-000797 Herke, W. H. AN EASILY MADE, DURABLE FISH-MEASURING BOARD. Prog. Fish-Cult. 39 (1): 48-49. Jan. 1977. SFA 22(2)
[La. Coop. Fish Res. Unit, La. State Univ., Baton Rouge 70803]

76-000798 Yeh, C. F.; Hodson, R. G. EFFECTS OF FORMALIN ON LENGTH AND WEIGHT OF BLUEGILL AND WHITE CRAPPIE FROM LAKE NASWORTHY, TEXAS. Southwest. Nat. 20 (3): 315-322. 10 Oct. 1975. SFA 22(2)
[Stone & Webster Eng. Corp., P.O. Box 2325, Boston, MA 02107]
Bluegill and white crappie from Lake Nasworthy, Texas were weighed and measured when alive and again 13 and 60 days after preservation in 10 percent formalin. Both species shrank slightly in length and increased significantly in weight. These changes had pronounced effects on the coefficient of condition which varied from 108.46 to 117.67 percent of live values, depending upon the species of fish and the time in preservative. The effect of formalin on the length-weight relationship in white crappie varied with size of fish. No generally usable standard correction factor for length-weight studies of preserved fish was found in this study.

REVIEWS, BIBLIOGRAPHIES, ETC.

76-000799 U.S. Environmental Protection Agency ORD PUBLICATIONS SUMMARY SEPTERMBER 1976. U.S. Environ. Prot. Agency ORD Publ. Summ. EPA-600/9-76-013c. vi + 278p. sept. 1976. SFA 22(2)
[Office Res. Develop., Cincinnati, OH 45268]

76-000799 CONTINUED
SPORT FISHING TECHNIQUES

76-000800 Freeman, B. L.; Walford, L. A. ANGLER'S GUIDE TO THE UNITED STATES ATLANTIC COAST. U.S. Dep. Commerce, NMFS, Washington, D.C. July 1976. Available from Superintendent of Documents, U.S. Gov't. Printing Office, Washington, D.C. 20402]

This 8 section (volume) publication is a geographical study of marine recreational fishing which covers the east coast of the united States from Maine to Florida and from the innermost reaches of the estuarine zone seaward to the edge of the continental shelf. The first type, Of which this is an example is an atlas dealing with the location of the fishing grounds, the various fishing and boating facilities, local conditions, and characteristics of fishing, as well as dignostic features, life habits, and environmental requirements of fishes that are of particular interest to anglers.--RS

WATERSHED MANAGEMENT

76-000801 Segretto, P. S. THE RELATIONSHIP BETWEEN URBANIZATION AND STREAMFLOW IN THE HILLSBOROUGH RIVER BASIN, 1940-1970. Ph. D. dissertation, Univ. Fla. 284p. 1975. From diss. Abstr. Int. B Sci. Eng. 37(7), 1977. SFA 22(2)

The results from this study have shown that increased urbanization has generally increased streamflow. However, localized field observations have also shown that increased surface runoff has decreased ground water recharge, thus decreasing base flow during low flow periods. Overall, increased urbanization in the study area has intensified the regional water problem.--From abstr.

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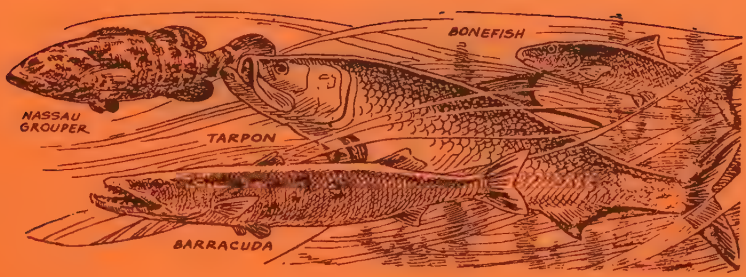

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Africa: Lake Tanganyika
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Africa: Pacific Ocean
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Alabama
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Alabama: Tennessee River
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Alaska: Auke Creek
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